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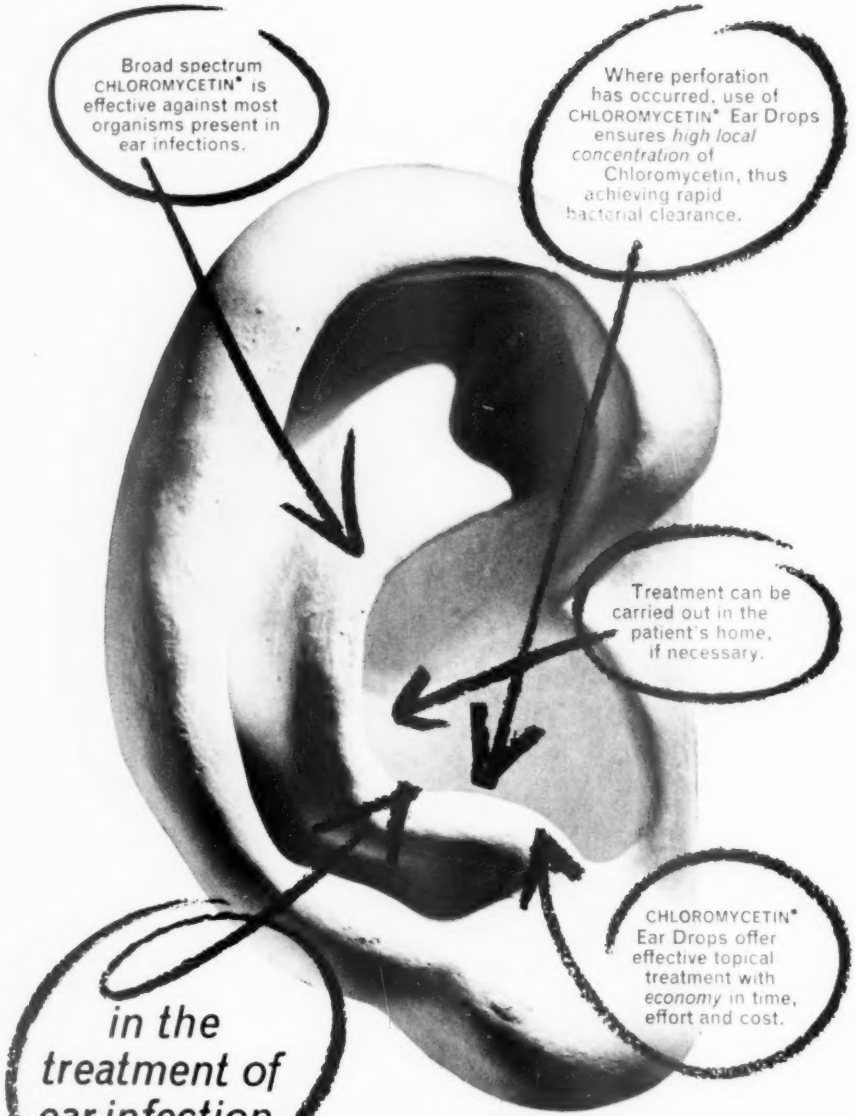
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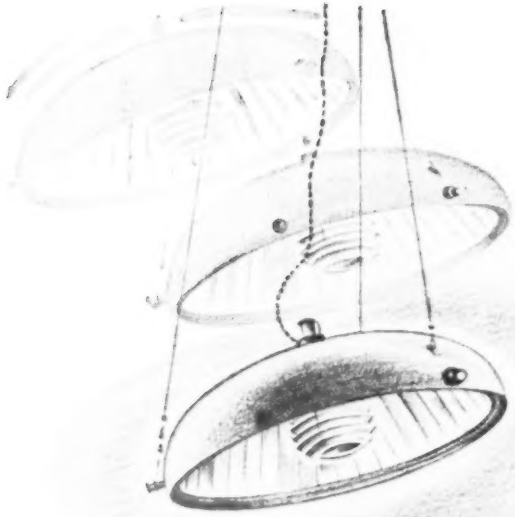

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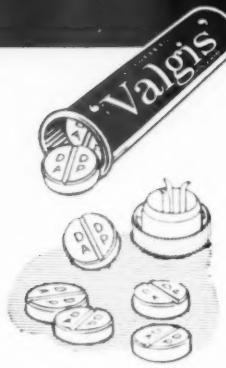

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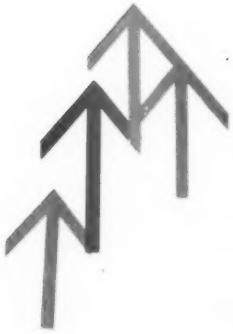

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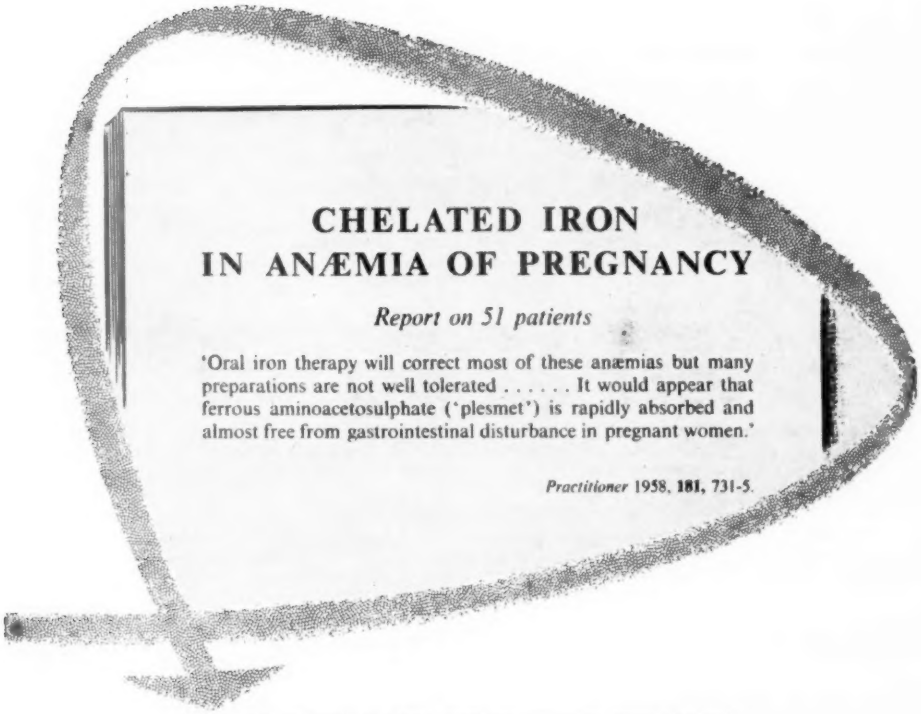

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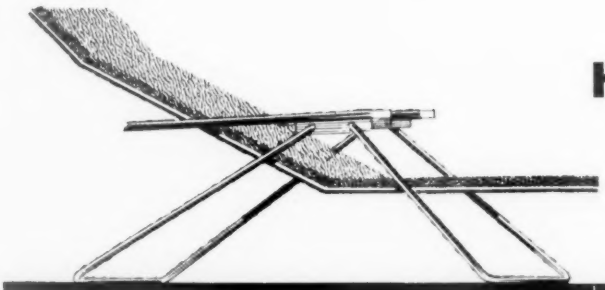

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President—B. W. RYCROFT, O.B.E., F.R.C.S.

Meeting
October 8, 1959

Observations on Corneo-plastic Surgery [*Abridged*]

PRESIDENT'S ADDRESS

By B. W. RYCROFT, O.B.E., F.R.C.S.

London

CORNEO-PLASTIC surgery may be defined as the reconstructive surgery of the eye and of associated structures by the use of graft, tube or flap, based on general principles of plastic surgery adapted to the special requirements of ophthalmology. In practice it has been found that there is wide scope for the application of these principles and they crystallize into four main groups; these groups are associated with conditions of the lids, lacrimal apparatus, the cornea and the socket. Thus, there lies between the elegance of modern plastic surgery on the one hand and the ancient traditions of ophthalmic surgery on the other hand a common territory which, so far, has been inadequately charted by pioneers from either side.

Like so many recent developments in surgery, corneo-plastic surgery is a product of war, born of the combination of the plastic surgeon and the ophthalmic surgeon in the Maxillo-Facial Units of the Army Medical Service, a combination which resulted in improved knowledge for the surgeon and better treatment for the patient. Although the urgency of war has passed, there is an increasing need for this type of combination for the missiles of war have been replaced by the urgency of speed on the road and in the air.

The Lids

Congenital ptosis represents a high proportion of our work at the Corneo-Plastic Unit at East Grinstead, and during the last ten years about 200 cases have been treated. As a result of varied experience an attempt has been made to formulate a method of treatment which is applicable to most cases, and suitable for the skill of the average surgeon.

In the earliest times it is recorded that Arabian surgeons treated the ptosis of their day by the simple excision of redundant lid tissue (Valude, 1910); such cases would generally be due to trachoma and the immediate results would be satisfactory. These methods obtained down to the time of Scarpa about 1811 (Scarpa, 1811). At this time the father of Albrecht von Graefe was Professor of Surgery at the University of Berlin and he is often considered as the father of plastic surgery (von Graefe, 1863); he introduced rhinoplasty and blepharoplasty, and was followed by Johann Friedrich Dieffenbach. It is reasonable to suppose that, under the influence of these two men, young Albrecht von Graefe would have had ample opportunity for studying the surgery of ptosis and it is not surprising that he modified the old Arabian method of skin excision by the removal of a strip of the orbicularis muscle also. Shortly afterwards, on his tours through Europe, he probably spoke of his operation to colleagues in Paris, Vienna and London. In London he was a friend of Bowman, and in the first volume of Moorfields Reports (Bowman, 1857) is an account of an operation for ptosis by Bowman. The time is the autumn of 1857; the place is Moorfields and Bowman at that time would be just over 40 years of age. Tall, dark and handsome, he stands ready to operate, probably in his long black coat with his sleeves rolled up. General anæsthesia had just come in, but antisepsis was still ten years ahead.

The registrar, Dr. Bader, writes: "In six cases, for ptosis—in four of these the usual operation of removal of an oval piece of skin was adopted. The disadvantage of this method is the loss of the natural fold between the orbital edge and the globe. In one case in which this operation had been done with an unsatisfactory result, Mr. Bowman applied a new plan—he everted the lid, and excised the posterior or upper edge of the palpebral cartilage, with about half an inch of the tendon of the levator palpebræ inserted into it. Before the actual removal of the piece, very fine threads were passed so as to bring together the edges, and thus secure a shortening of the tendon of the levator muscle, to the extent of three-quarters of an inch. It is expected that thus it will be permanently shortened, and be enabled to assist in raising the lid."

This was a simple operation, and as far as I know, the first description of resection of the levator for the treatment of ptosis. In latter years a supratarsal line of sutures was added by Blaskovics (1923) but, in essence, the original idea was that of Bowman.

FIG. 1.

FIG. 2.

FIGS. 1 and 2.—Bilateral adult ptosis before and after correction by the Bowman transconjunctival operation (A. Warb).

The decision as to what type of operation should be done for congenital ptosis depends on the presence or absence of the levator palpebræ superioris muscle. The test which determines this is that described by Grimsdale and Brewerton (1907) whereby the action of the orbicularis is eliminated by pressure over it when an attempt is made to elevate the lid; any elevation which is then present is due to the action of the levator. If there is definite levator action, or even a suspicion of it, then resection of the muscle and tarsal plate through the transconjunctival route of Bowman gives very satisfactory results (Figs. 1 and 2). [The technique of the operation was then shown by stereoscopic projection of slides and a film.]

Some surgeons prefer to approach the levator tendon by the transcutaneous route and excellent results are achieved. In our practice this route is reserved for second or third attempts and especially where there is extensive scar tissue from trauma or burns. The criticism which has been levelled at this operation is that it sometimes leaves a deep puckered scar and that the orbital fascia may be opened and orbital fat is extruded.

20% of all cases of congenital ptosis have no levator action and are often combined with other congenital defects, such as epicanthus. For these, the lift of the lid has to be transferred by a sling, either to the orbicularis and frontalis or to the superior rectus. Few of these shift operations are satisfactory.

If one is going to use a sling, then an autograft is preferable, either by fashioning a sling from the orbicularis muscle, as in the Reese operation (1924), or by a free graft from the extensor tendon of the little toe; this is easily done by an incision on the dorsal surface of the toe and the tendon is then mobilized under artery forceps (G. Romanes).

No longer should fascia lata be taken from the thigh because an undesirable scar is always left, and sometimes there is herniation of muscle. The criticism of these slings is that they do not leave a supratarsal fold and a flat lid is the result; as Law puts it, lift of the lid is only obtained by a "grimace". Law favours the Dickey operation (1936) which consists in passing a sling of fascia underneath the superior rectus and attaching it to the tarsal plate; this is probably the best of those operations which involve the superior rectus. Certainly the Motais operation should be completely discarded because diplopia, entropion and hypopion ulceration of the cornea may result. Although the Trainor operation (1935) is easy and fixes lid and globe together, the general appearance is not good. In principle, my experience is against the use of the superior rectus muscle but there is the occasional exception where the Dickey's sling operation may be used.

Occasionally one meets with the Marcus Gunn phenomenon.[1] The exact reason for this disordered combination of muscle movement is not known but there are many theories. For treatment we have reached definite conclusions:

(1) A piece of the levator tendon must be freely excised as a first step. It is not sufficient merely to incise the tendon as it will certainly immediately unite, and the winking will be as bad as ever. A band of tendon, about 20 mm long by 4 mm wide should be removed.

(2) The second stage occurs three months after the first stage, during which there should be complete ptosis of the lid. A sling or Dickey operation by fascia is carried out to complete the treatment.

Every ophthalmic surgeon should have in a drawer of his desk some sweets. If a sweet is

[1] A short film of such a case was shown.

given to every patient with congenital ptosis, it is surprising in how many the upper lid moves when the jaw is moved; this is invariably part of the investigation of congenital ptosis.

Over-correction is far less common than under-correction following these operations. Indeed, it is better to aim at over-correction which can easily be corrected a few days after operation, whereas it is difficult to increase the lift of the lid once the operation has been performed. In the Bowman operation the ratio of tissue excised consisting of tendon and tarsal plate should be 4 mm of tissue for every 1 mm of lid lift required; if there is over-correction it is easy enough to remove the stitches and gently pull down the lid to correct the level. Should this fail, then the muscle can be teased off the tarsal plate quite easily by an iris repositor, and the lid lowered still more. In sling operations it is very occasionally necessary to divide the sling by subcutaneous section after putting it on the stretch.

There should be no corneal exposure after the Bowman resection operation but it is almost inevitable after the sling operation, owing to the immobility of the lid. The eye will not tolerate corneal exposure long, but 2–3 mm of conjunctival-scleral exposure can be tolerated for years without any undue harm. To summarize, the important points in the Bowman resection are:

(1) The identification of tissue planes, making certain that the levator is clearly defined from the orbicularis muscle lying deep to it.

(2) The even placement of stitches to avoid angulation.

(3) Adequate excision of tarsal and levator muscle.

(4) The use of a contact glass to protect the eye during the operation, and,

(5) hypotensive anæsthesia is of great assistance.

If the child is too young for hypotensive anæsthesia then table tilt to 30 degrees is helpful. Firm fixation of the upper ends of the sling is very important; Matthews (1949) drills the frontal bone so as to get a firm fixed point from which the sling can act.

TABLE I.—SUMMARY OF PTOSIS SURGERY (Rycroft, 1957)

1. SKIN EXCISION
   Arabian Surgeons
   Scarpa, 1811
   Von Graefe, 1854

2. INCREASED LEVATOR LIFT
   (i) by transconjunctival excision (Bowman, 1857)
   (ii) by folding (Everbusch, 1883)
   (iii) by transcutaneous excision (Wolff, 1896)

3. TRANSFER OF LIFT TO FRONTALIS BY
   (i) skin slide (Hunt, 1830)
   sutures (Dransart, 1880)
   skin strap (Panas, 1894)
   fascia (Payr, 1908)
   muscle strip (Reese, 1924)
   suture (Friedenwald, Guyton, 1948)
   (ii) from frontalis by muscle strip (Fergus, 1901)
   (iii) to orbital fascia by sutures (Wilder, 1898)
   (iv) to superior rectus by muscle (Motais, 1897)
   tarsal strap (Greeves, 1933; Trainor, 1935)
   fascia sling (Dickey, 1936)

Reconstruction of the Upper Lids

The ophthalmic surgeon must appreciate his limits in the reconstructive surgery of the lids; four methods of technique are suitable:

(1) The use of free skin grafts from the inner surface of the forearm (Thiersch graft), or from behind the ear (Wolfe). The former thin grafts are useful for repairing skin deficiencies in the upper and lower lids, resulting from the secondary contraction of burns, either by fire or radiation, whereas the full thickness post-auricular Wolfe graft is used to repair small deficiencies after the excision of tumours and where there is greater loss of tissue.

(2) Sliding flaps after the Blascovics type are used in entropion and ectropion and after excision of lid tumours.

(3) The Tripier type of flap, in the form of a bucket handle, is often useful to repair the raw area left by the correction of an inferior symblepharon. A strip of conjunctiva from the upper fornix is swung down to cover the deficiency. It is also useful in the reconstruction of upper and lower lids.

(4) The Z-plasty manœuvre is of value where there is no great loss of tissue, altering the line of tension from a vertical to a horizontal direction, and vice versa. The treatment of epicanthus is based largely on the modification of Z-plasty.

Although the tube pedicle graft was invented by the ophthalmologist, Filatov, the use of this specialized technique is better left to the plastic surgeon; it is mainly used in corneo-plastic surgery for the total reconstruction of the upper and lower lids.

Lacrimal Apparatus

Associated with the Corneo-Plastic Unit at East Grinstead is a Maxillo-Facial Unit in which a large number of cases of fractured jaw are treated. A high proportion of damage to the tear ducts occurs in these cases; there is also a Burns Unit, which provides cases of complete obliteration of the lacrimal apparatus. Other cases due to chronic infection are referred by colleagues from elsewhere. Over the last twelve years this concentration of lacrimal surgery has led to definite conclusions.

Dacryocystography is of paramount importance because: (1) it determines the type and level of the obstruction, (2) it delineates the area of the sac, (3) it will show loculi of the sac, which must always be eliminated in subsequent surgery if adequate drainage is to be ensured, (4) it may suggest the diagnosis, e.g. irregular sac in fundus infection (Fig. 3), (5) it may show sources of drainage to unusual places, such as the antrum.

For dacryocystography a watery solution is used when previous obstruction is suspected after

FIG. 3.—Dacryocystogram of streptothrix infection of the lacrimal canaliculi and sac.

preliminary lacrimal investigation, a thin oily solution when there is partial patency. The radiographic area is enlarged for easier examination (Dr. W. Campbell).

In the investigation of a case of lacrimal obstruction, a careful clinical history should be taken to exclude previous injury to the nose or face, chronic infection or operations on the nose or sinuses, the duration of watering and the degree of nuisance which is caused, e.g. with or without overspill. Neoplasm of the antrum or nose is borne in mind. The occupation of the patient is of importance; he may be a fishmonger with both hands occupied on a cold morning! Traquair (1941) states that 60% occur in females and 40% are bilateral.

Slit-lamp examination of the punctum should be done to exclude the presence of fine lashes or accessory dimples. Lacrimal irrigation should always be carefully performed and the punctum gently dilated with a sharp dilator; when properly used and greased it is preferable to the blunt Nettleship pattern.

Dacryocystography will determine the level of the obstruction and at East Grinstead the following classification is used:

(*a*) In high level block fluid regurgitates through the contralateral canaliculus but does not enter the sac. At operation it is often seen that there is a small loculus joining the upper and lower canaliculi and occupying part of the lumen of the sac; this is an exaggeration of the normal anatomical ampulla of Meier. In these cases it is essential to excise the adventitious loculus within the sac cavity to cure it. Frequently, because of long disuse, the main lacrimal duct also is closed and rhinostomy becomes necessary.

(*b*) A middle block accounts for 70% and is due to constriction at the neck of the sac where the membranous portion passes into the bony canal.

(*c*) A low level block occurs just where the root of the inferior turbinate crosses the lower end of the canal in the vicinity of the valve of Hasner. Every patient is first investigated by an ear, nose and throat specialist, for some can be cured by local treatment to the turbinate, or by excision of the anterior end. Probably this is one of the few examples of adult lacrimal obstruction yielding to the passage of lacrimal probes.

(*d*) Composite type of lacrimal block in which there are several obstructions at different levels.

The fluorescein test has not been found of value in our clinic but the Schirmer test is generally used as a control. Having decided on the type of obstruction, an operation is performed as shown in Table II.

TABLE II.—SUMMARY OF LACRIMAL SURGERY

Partial canaliculectomy	Canaliculostomy
Reposition	Dacryocystorhinostomy —without tubes —with tubes
Permanent inlays (La Rocca, 1948; Summerskill, 1952)	Dacryocystectomy
Canaliculorhinostomy (no sac)	Canaliculocystorhinostomy (with sac)
Canthocystostomy (with sac and no canaliculi)	Canthorhinostomy (no sac and no canaliculi)
Adenectomy	Neurectomy (Whitwell, 1958)
Section of ductules	Radiation
Alcohol injection	Spectacle pads

If the inferior punctum is patent but out of place, cautery apposition will relieve the watering, but care must be taken that this displacement of punctum is primary and not secondary to a main duct obstruction, and has been produced by wiping the eyes. The operation of Bowman or 3-slit operation is very valuable for stenosis of the puncta and canaliculus, provided it is properly carried out. If the punctum alone is stenosed, then partial canaliculostomy, either by scissors or trephine as suggested by Rubens, is sometimes adequate but more often closes up; in our experience, complete excision of the posterior wall of the canaliculus, right into the lacrimal sac, followed by the use of a greased pack, for a week, is the only sure way to get drainage when stenosis of the punctum and canaliculus is involved. Sometimes an exuberant caruncle obstructs the opening in the canaliculus, but a few touches of cautery will cause it to shrink and allow the slit canaliculus to drain.

Where the obstruction is in the ampulla it is absolutely necessary to use polythene tubes for four months, to avoid secondary contraction and closure of the canaliculi.

Where the punctum, canaliculi and sac are patent, but where there is obstruction at the middle or lower end of the nasolacrimal duct, the flow of tears must be diverted into the nose.

The best operation is that of Dupuy-Dutemps (Dupuy-Dutemps and Bourguet, 1921) originally devised by Ohm (1920) which involves suture of nasal mucosa to mucosa of the sac. The operation used at East Grinstead is a modification of the Dupuy-Dutemps operation with the Mosher high incision. We do not follow Mosher and deal with deflected septums or curette the anterior ethmoidal cells, but we prefer his high incision to that of Toti which was 3 mm nasal to the internal canthus.

The modifications from the Dupuy-Dutemps operation are as follows:

(1) The use of the Rycroft intranasal lamp; this has been found invaluable in noting deep bleeding points, the previous presence of an anterior ethmoidal cell, delineation of the angular vein, and excellent illumination of the depths of the bony opening. The condition of the middle turbinate can be clearly seen and removed if it appears likely to block the rhinostomy opening.

(2) The use of the high incision which avoids a bowstring effect and is almost invisible when closed by an intracuticular suture.

(3) The hand trephine modified from that of Arruga. Hand power is preferred to mechanical power because it is easier to feel exactly when the bone is traversed and also it is safer in emphasizing the pressure on the harder parts of the bone anteriorly and easing it posteriorly. By the use of a hand trephine it is practically impossible to damage the nasal mucosa.

(4) The use of special needles modified from Denis Browne cleft palate needles.

(5) A catheter is always left in place for one week, separating the anterior and posterior suture lines so that there is no adhesion by blood clot.

(6) Hypotensive anæsthesia is of the utmost value, especially in traumatic cases.

If the sac has been previously removed, it is still possible to get relief of watering by surgery and the operation is that of canaliculorhinostomy, originally described by Arruga (1946). In this operation an attempt is made to fashion a sac of nasal mucosa and back cutting of the flaps containing the canaliculi. Polythene tubes are essential to maintain patency. If the lower canaliculus is completely obliterated, then it is possible to help epiphora by surgery, provided the main duct is patent. The upper canaliculus is slit down as far as possible to the neck of the sac and the two flaps are separated by greased packing. The posterior pack is previously trimmed.

Where there is no sac and no canaliculi then an attempt must be made to fashion a new passage by the use of a free graft of mucous membrane from the cheek (Fig. 4). At the 1950 International Conference of Ophthalmology, the author presented a report on a series of canthorhinostomies (Rycroft, 1951), but the results were not satisfactory and the operation was largely abandoned. However, review some years later revealed to our surprise that half of these patients were freely patent and had been relieved by the operation.

FIG. 4.—Canthorhinostomy. The patent conjunctival stoma is seen ten years after operation: there is no epiphora.

There remains that distressing group of cases of epiphora where there is no canaliculus, no sac and no possibility of obtaining anatomical drainage into the nose by normal channels. Such cases result from severe burns and from certain skin deformities. In cases of severe burns it is most undesirable that any attempt should be made to reduce the epiphora, since such epiphora is a safeguard to corneal exposure. These patients have usually had multiple free grafts to all four lids with much distortion and contracture so that there is nearly always secondary exposure. Although these patients complain of epiphora it should be explained to them that this is a safeguard. There is, however, a small group generally due to skin conditions where something must be done and for these it is reasonable to consider some means of extirpating or controlling the production of tears. Such methods are Jameson's (1937) subconjunctival ductule section which we have found to give equivocal results, the injection of alcohol which has been reported as causing permanent paralysis of the external rectus, and sometimes irradiation. For example, a patient was irradiated over the lacrimal gland

and she was sent to us for excision of the globe for uncontrolled keratitis sicca. A contact glass relieved her condition considerably but extreme care is necessary in irradiation of the area of the lacrimal gland or sac. Extirpation of the lacrimal gland has given, in our hands, very doubtful results, as indeed it has in the hands of many other surgeons. Partial excision of the gland almost never improves the watering and total excision has had similar results. I have yet to see an eye with normal coverage in which keratitis sicca has been produced by removal of the lacrimal gland and, indeed, I have not seen any complications from this procedure.

TABLE III.—SUMMARY OF RESULTS OF LACRIMAL SURGERY (EAST GRINSTEAD)

Operations	Total	Patent	Blocked	Partial	No better
Dacryocysto-rhinostomy (1st)	152	134 (93%)	18	—	—
Dacryocysto-rhinostomy (Repeats)	8	4 (50%)	4	—	—
Dacryocysto-rhinostomy with polythene tubes	20	10 (50%)	10	—	—
Cantho-rhinostomy	17	12 (64%)	5	—	—
Canaliculo-cystostomy or upper canaliculus 3-snip	6	3 (50%)	3	—	—
Adenectomy	30	—	—	15	15
Neurectomy	3	—	—	2	1
Radiation	—	—	—	—	—
Alcohol	—	—	—	—	—

Corneal Grafts

To surgeons who performed corneal grafts before the last war, the present state of the operation in this country shows a remarkable change. The operation hardly had time to capture the interest of British ophthalmic surgeons before 1939, when the careful painstaking and pioneering work of Tudor Thomas laid the foundations for corneal graft surgery in this country. In those days the operation was an unpredictable adventure; instruments were immature, antibiotics unknown, but the satisfaction of having a corneal graft heal, let alone remain transparent, was sufficient reward.

Nowadays successful grafts are a commonplace, yet problems remain and it is these that I would emphasize rather than the routine aspects of what Dieffenbach (1831) called an "audacious fantasy".

The selection of the case has become more predictable. It has been accepted for a long time that those patients who do best with full thickness grafts are those in whom some portion of the graft abuts on normal corneal tissue. Take, for example, the general success rate of 90% in cases of keratoconus, which is made possible by a large corneal graft reaching out beyond the base of the cone to arrange itself along corneal tissue of normal thickness. The figure of 80–90%, as reported by Paton (1952), is not exceptional in this type of pathology. But what has occupied attention more especially recently is a study of the discrepancy in the thickness of the host compared with the thickness of the normal corneal tissue, and, coincidental with this, the role which the endothelium plays in maintaining transparency. There is considerable evidence to show that if the endothelium does not seal the posterior incision quickly, œdema of the graft will follow. In technique the question of fixation has been discussed to a great extent during the last ten years. It is clear that various surgeons obtain successful results with different methods of technique, whether it be by overlay sutures alone, or combined with a splint, or with a splint and direct sutures, or with direct sutures alone. Our practice at East Grinstead has been to use many methods and we have a general plan that with full thickness grafts of up to 7 mm in diameter we do not use direct sutures, but over this size they are employed; we have used overlay sutures with and without egg membrane or splints with much the same percentage of success (Fig. 5). Anterior

FIG. 5.—Penetration corneal grafts. Three grafts had previously failed in the right eye. Bilateral 7 mm full thickness corneal grafts were performed and resulted in normal vision in each eye both for distance and reading (B. W. R.).

synechiæ are no longer a problem because if there is a quick seal or air insufflation before the patient leaves the table, it is unusual to develop an anterior synechia, and we only separate such an adhesion once or twice a year. The value of a pressure bandage when the stitches have been removed at the end of a fortnight has been fully proven, and it can reduce ectasia up to three weeks from the date of operation. Diamox also has been found of value in reducing œdema and ectasia of the graft.

During the last few years the scope of full-thickness keratoplasty for optical purposes has

increased as well as for therapeutic uses, and it is the method of choice for the surgery of descemetocele.

The partial thickness graft has declined in popularity as a means to improve vision, since the more difficult and dangerous full thickness graft has now become safer for optical purposes; nevertheless, the lamellar graft has an important role to play, either as immediate or delayed treatment (Fig. 6). It is the method of

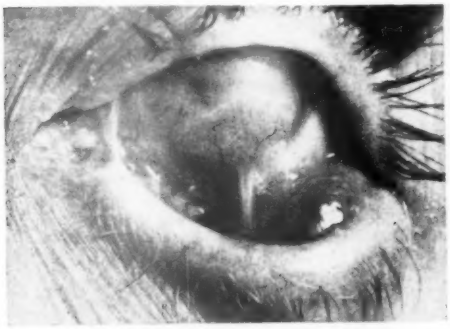

FIG. 6.—Ocular pemphigus. A fresh bulla is seen alongside a symblepharon. There is dense superficial corneal scar tissue formation and vascularization. Subsequently a deep lamellar graft was carried out and when this was combined with a contact glass (F. Ridley), the corrected vision was then 6/18.

choice for indolent keratopathy and for the preliminary preparation of a diseased vascularized cornea for a full thickness graft later; it has also been suggested as an immediate outpatient procedure for active keratitis.

It is fair to say that of all cases of full thickness keratoplasty carried out for improvement of vision, 80% now succeed, which is a considerable improvement on 10% prior to the last war.

There are problems, however, which remain. So far as the eye is concerned the problem of late œdema has not yet been solved. Then there is the problem of allergy but this is rare; before a graft can be said to fail because of allergy, mistakes in selection and technique must be excluded.

A world-wide problem is that of an adequate supply of sterile fresh donor material and this has engaged us for a long time at East Grinstead, especially in respect of its preservation.

The three general methods of preservation are: (1) By antibiotic (0·5% Soframycin) water vapour at 4° C which is satisfactory for three days. (2) In liquid paraffin at 4° C which is satisfactory for a week (Burki, 1948). (3) By one of the methods of dehydration with and without deep freeze preservation. This group is still in the unproven stage so far as full thickness material is concerned. King (1957) believes in dehydration in 95% glycerin and preservation at room temperature without freezing; Henaff (1960) believes in dehydration with freezing, and we at East Grinstead use deep freezing without dehydration, but with glycerin protection. Research still continues, for it is imperative that a method universally satisfactory should be evolved to preserve every possible useful cornea in banks.

The Socket

There are two main reasons for the surgical correction of a socket, namely, to enable an artificial eye to be worn and to stop offensive discharge. Inability to wear an artificial eye is due to contraction in varying degrees of the socket. In mild degrees it is usually the lower fornix which will not contain the lower edge of the artificial eye, whereas in more severe degrees the whole of the socket is contracted from lifelong irritation. Extreme forms of socket contracture are seen in collagen diseases such as pemphigus and essential shrinkage or from severe burns and trauma.

The type of treatment which is necessary in contracted socket depends on whether an eye is present or not.

Partial reconstruction of a socket usually means that the upper or lower fornix must be increased in depth, and the most effective means of doing this is by free grafts of buccal mucous membrane. Preferably, these are taken from the lining of the cheek rather than from the back of the lip as there is less discomfort to the patient when the grafts are taken from this position. The grafts are made as thinly as possible and securely anchored to the deep structures. The use of the Walser shell (1958) has greatly facilitated the reconstruction of upper and lower fornices.

A new procedure for the treatment of severe contraction of the socket has been evolved at East Grinstead (Rycroft, 1960). In an industrial country such as ours there is an economic limit of time to which a patient can go in the treatment of cosmetic defect. The reconstruction of a socket, fornix by fornix, graft by graft, is a long and tedious procedure, and often the results in severe cases are not much better than the original condition. It seemed that with the advance in the construction of plastic prostheses it should be possible to shorten the length of stay in hospital and to produce an adequate result by quicker means. The method recommended for severe contraction of the socket is a total excision of the socket combined with a prosthesis.

The technique is to excise the entire mucous lining of the socket, the lacrimal gland and the lash-bearing areas of the lids. The incision is

slightly lengthened and then the deep structures are closed with catgut and the skin edges are brought together, to give a smooth skin surface to the socket. Thereafter, a plastic prosthesis is mounted on this by adhesive, or held in place by spectacle frames and the cosmetic result in the primary position of the head is excellent.

Acknowledgments.—Many Registrars of the Corneo-Plastic Unit at East Grinstead have shared this work and I am under constant indebtedness to them for their help, and enthusiasm.

Mr. Gordon Clemetson of the Photographic Unit has kindly provided the illustrations and all prosthetic appliances which are used at East Grinstead are made by Mr. Warren of Messrs. Clement Clarke Ltd., London.

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Meeting
February 11, 1960

CLINICAL MEETING HELD AT THE WESTERN OPHTHALMIC HOSPITAL, LONDON

37 cases were shown including a series of therapeutic corneal grafts, a number of abnormal fundi, corneal dystrophies and degenerations, Duane's retraction syndrome, and Marchesani's syndrome.

A discussion was held on the following cases:

Iris Nodule.—Dr. N. GIBBONS (for Mr. REDMOND SMITH).

Two Cases of Marchesani's Syndrome.—Mr. R. JONES (for Mr. A. G. CROSS).

Three Cases of Vascular Abnormalities of the Fundus. — Mr. C. G. KEITH (for Mr. REDMOND SMITH, Mr. R. MCI. PATON and Mr. J. O. BRIDGEMAN).

(1) **Two Cases of Blood Staining of the Cornea. (2) Progressive Internal Ophthalmoplegia.** —Mr. REDMOND SMITH.

Congenital Anterior Synechiæ Associated with Glaucoma.—Mr. C. G. KEITH (for Mr. R. MCI. PATON).

Atypical Coloboma of the Choroid with Aberrant Retinal Vessels.—Dr. M. B. R. MATHALONE (for Mr. REDMOND SMITH).

Therapeutic Grafts.—Mr. A. G. LEIGH.

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United Services Section

President—Air Marshal Sir HAROLD WHITTINGHAM, K.C.B., K.B.E.

Meeting
December 3, 1959

DISCUSSION ON ARTIFICIAL RESPIRATION

Professor Ronald Woolmer (London):

First Aid in Acute Respiratory Failure

The fighting Services may be exposed to most of the causes of respiratory failure which affect civilians, and a few extra ones. They are more likely than civilians to undergo involuntary immersion, and to be exposed to toxic fumes and nerve gases. They are also more likely to receive wounds involving the chest or respiratory tract, and to sustain cerebral injuries. They have the advantage over civilians that they are usually healthy—life's candle is not so easily snuffed out—but the disadvantage that they are more likely to be in situations in which effective resuscitation is difficult. Most methods of resuscitation require at least the room to swing a cat.

Acute respiratory insufficiency is often a temporary condition, fatal in a few minutes if unrelieved, but possibly disappearing with no residual disability and leaving the subject fighting fit if treated promptly and effectively. The loss of any man who is capable of being revived *by any method* is therefore culpable, and it is imperative that the full range of methods applicable to different situations should be available to Service personnel, in so far as they can be provided.

The treatment of acute respiratory failure is simple in principle. It consists in the restoration of gas exchange across the pulmonary membrane. For this one needs to have a change of air in the alveoli, and a change of blood in the pulmonary capillaries. The one is no good without the other. This is merely another way of saying that artificial respiration will not help a dead man; but we have learnt in the last few years that death is not easy to define: certainly it is not synonymous with cardiac arrest. If an anoxic heart, beating too feebly to produce a perceptible pulse, can still drive a trickle of blood through the pulmonary circulation, and *that blood can take part in gas exchange*, the myocardium will feel the benefit a few seconds later, and rapid and complete recovery is then a possibility. So that when I say that there must be a change of air and a change of blood for resuscitation to be effective, I do not mean to imply that the *rate* of change of these two (which is of course approximately equal in health) need even approach equality.

It is not easy, even for the expert, to decide whether or not there is any blood going through the pulmonary circulation, and there is not much that can be done, *directly*, to influence it. But it *is* easy, even for the layman, to decide whether any change of air is taking place, and there is much that can be done to promote it. We have, then, to leave the circulation to look after itself or, rather, we have to depend on an *indirect* method of helping it, and concentrate on ventilation—on restoring the bellows action of the chest—for I do not believe that a block to diffusion is often of importance. The analogy between the chest and a bellows is useful. The bellows has a pair of handles, or arms, which are firmly attached to the sides. Pull the arms apart, and the air is drawn in. This is efficient. But suppose that the arms are not rigidly attached to the sides but connected rather loosely, by elastic cords or springs. Now pulling on the arms is no longer an efficient way of drawing air in. Nor is arm lift when applied to the human subject.

Most bellows are a little elastic and contain some air in their resting position. In default of effective handles we can draw air into the bellows by first squeezing them flat, and then allowing elasticity to return the sides to the resting position. But in this way we can suck in no more than we squeezed out, which in most bellows is not very much. This is inefficient, like the chest-squeezing methods applied to the human subject. A combination of the two methods—squeezing and pulling—will be better than either alone; in the human subject Holger-Nielsen's method is more efficient than Schafer's. But if we have a second full bellows and connect it directly to the first, we can *push* air in instead of trying to *suck* it in, and the process at once becomes efficient.

It is helpful occasionally to reappraise methods that have been in use for a long time; and in making such a reappraisal it is often useful to approach the problem from a new angle. If a practical man were asked how to inflate a bellows whose sides could not be pulled apart, it is obvious what his answer would be: "Blow into it." I

think the analogy is fair, but it is, of course, an over-simplification. Although the positive method is mechanically superior to the negative one, other considerations apply when it is translated from inanimate bellows to living—or almost living—bodies. When a machine is used to apply positive pressure, oxygen or atmospheric air may be used as the inflating gas, but when the human expiratory muscles are used, the composition of the inflating gas may not be ideal. The old idea that expired air is poisonous was perhaps natural to early physiologists, and its prevalence delayed the adoption of the expired air method. There is now abundant evidence that, though not ideal, expired air is an efficient inflating gas for respiratory resuscitation.

It will be clear from my analogy that the direct method will not work if there is an obstruction in the tube connecting the two bellows: and the negative pressure method, by which the air is *sucked* into the recipient bellows, will not work if the nozzle is blocked. In other words, obstruction will defeat any method of artificial respiration. Rescuers *must* be trained to maintain a patent airway. This is easier with positive methods than with negative ones because at least one hand is free.

It can be argued that the supine position required for expired air resuscitation makes airway obstruction—whether by soft tissues, foreign matter or water—more likely, and less easily rectified, than does the prone position. The answer to this is that though it is expedient to counter *soft tissue* obstruction by adopting the face-down posture when the hands are occupied, there is no need to resort to this when they are available to support the jaw, and foreign matter should be removed before starting in any case. Obstruction by water is probably not of great practical importance; unless there is no pulmonary circulation, water is absorbed rapidly from the lungs. Thus the adoption of the supine position for the positive method is not a disadvantage.

One difficulty which arises with positive methods but not with negative ones is the provision of an airtight fit between the source of pressure and the patient. This is often difficult, and some leakage is usually inevitable. To compensate for this, positive pressure methods should be capable of delivering at least a litre a breath. All the positive methods under consideration can in fact do this. Blowing air is in most circumstances a better method than sucking t in, both in principle and in practice, and indeed the surprising thing is not that negative pressure methods are inefficient but that they can, in favourable circumstances, produce reasonable ventilation. I cannot think of many situations arising in the Services in which the negative method should be preferred to the positive. One obvious one is the presence of face wounds, but there are very few others.

Of the positive methods, expired air resuscitation has much to recommend it, because it requires the minimum of equipment, and because it makes use of the apparatus specifically designed by nature for moving air in and out of the chest: an apparatus which has a very considerable reserve of power. The direct "mouth-to mouth" application of expired air resuscitation—as distinct from the airway-to-airway application—is open to objection on æsthetic grounds. As an alternative to the respiratory muscles of the rescuer, a number of positive pressure devices are available in this country for first aid, including the Stephenson "Minute Man", the Porton Resuscitator, and the "Ambu" Resuscitator. The main disadvantage of these devices is that they involve equipment, and the essence of *first* aid is that it must be applied quickly without waiting for equipment to be brought. This disadvantage is possibly less important in the Services than it is in civilian life, because the fighting man is inevitably dependent upon a large number of items of equipment, and the organization for supplying them already exists. The allocation of the appropriate number of positive pressure devices to ships, aircraft or detachments of men would, I imagine, be a simple matter if this were thought desirable. Which of these devices should be supplied is perhaps not quite so obvious, but I would adopt the principle of "the further forward, the simpler." This would mean that devices like the Minute Man would be kept back, those like the Porton Resuscitator would be intermediate and the simplest, such as a double airway for expired air resuscitation, would be furthest forward.

Not only are methods which aim to expand the chest by blowing air in usually at least as good as those which aim to suck air in by expanding the chest, but there are some situations in which the latter method cannot be applied for lack of room as lifeboats, rafts, dinghies, air-sea rescue helicopters, aircraft, and crowded vehicles of all types. In such situations some positive-pressure method, such as expired air resuscitation, may be the only one which is feasible. If it is not available, lives will be lost unnecessarily.

There is only one way in which methods of respiratory resuscitation can be reliably *assessed* in peacetime—by trial on anæsthetized, paralysed human subjects. That is how positive-pressure methods have been tested and compared with traditional methods.

That, too, is the best way of teaching respiratory resuscitation. But anæsthetized, paralysed subjects are not an item of Service stores, and access to them is limited. I think we *should* make use of anæsthetized subjects in Service hospitals for teaching expired-air resuscitation, and I do not believe that there need be objections to this on ethical grounds. I have used surgical patients in this way and so have many of my colleagues, but obviously most of the teaching will have to be done in other ways.

Positioning and support of the jaw can be taught on conscious subjects, but they will not tolerate the insertion of an airway; and mouth-to-mouth resuscitation, without the interposition of an airway, cannot be practised on Service personnel for æsthetic reasons. Lectures, films and diagrams help, but a working model or manikin is preferable. Such models already exist in the United States, Canada and Denmark.

Surgeon Lieutenant J. Cox, R.N.:

An Assessment of Expired-Air Resuscitation [Abridged][1]

Expired-air resuscitation is an ancient method, first mentioned in the Old Testament, but abandoned in this country by the Royal Humane Society in 1812 as the expired air was thought to be poisonous (Keith, 1909). Since recent work has shown that manual methods are inefficient in a majority of cases, because of upper airway obstruction, interest in expired-air resuscitation has been revived (Gordon *et al.*, 1958; Safar, 1958, 1959*a*). The method depends on the donor doubling his minute volume, and it has been shown by several workers in America that it is efficient (Elam *et al.*, 1954; Greene *et al.*, 1957; Safar and McMahon, 1958). However, in this country, Lucas and Whitcher (1958) recorded a progressive respiratory acidosis.

In the present study expired-air resuscitation was carried out on 22 anæsthetized paralysed subjects undergoing elective surgery, using the mouth-to-airway method of Safar *et al.* (1958). The parameters measured were tidal volumes, using the integrating pneumotachograph, and end-tidal carbon dioxide of both donor and subject, using an infra-red carbon dioxide analyser. The experimental layout is shown in Fig. 1.

The results showed that expired-air resuscitation is a most efficient method, no respiratory acidosis occurring. No donor had difficulty in inserting the airway and carrying out expired-air resuscitation, and in contrast to the manual methods energy required was minimal.

[1]For full text *see Lancet* (1960) i, 727.

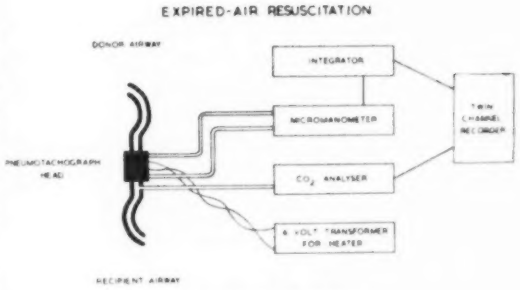

FIG. 1.

The advisability of adopting the method in this country as the standard method must depend on its "teachability". American results suggest that 90% of untrained non-medical men can carry out mouth-to-airway resuscitation successfully after one demonstration (Safar, 1959*b*). I would like the opportunity to confirm these results, for if they are confirmed in this country I see no bar to its adoption.

Many criticisms have been advanced against expired air resuscitation, of which the æsthetic objections are the most valid; however, if a double airway is used these do not arise. Infection of the victim by the donor has been recorded (Champneys, 1887*a*); infection is preferable to death from asphyxia. Lung rupture should not be a danger if the victim's lungs are healthy. In infants pressures in excess of 25 cm of water may cause damage (Champneys, 1887*b*). The fact that pressures of about 50 cm of water can be developed by this method is an advantage in victims with a low lung compliance. Gastric distension may occur, but is self-limiting, and has not been shown to cause untoward effects in adults (Safar, 1958).

My personal view is that the efficiency of expired air resuscitation outweighs any of the criticisms, and I hope that if I am ever in a position to require resuscitation, my rescuer will use this method and not waste time positioning my head and arms and pressing on my chest. Pressure on the lower thorax is a most efficient method of causing regurgitation of gastric contents.

The work which I have described was carried out on behalf of the Royal Navy in the Department of Anæsthetics at the Royal College of Surgeons, and at the Whittington and Middlesex Hospitals, in conjunction with Professor R. F. Woolmer and Sick Berth Petty Officer V. Thomas.

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——, and MCMAHON, M. (1958) *J. Amer. med. Ass.*, **166,** 1459.

Dr. Morris H. Brook (Saskatoon) said that experiments similar to those reported by Surgeon Lieutenant Cox had been carried out at the College of Medicine in Saskatoon with very similar findings. It was strongly felt there that the technique of expired-air resuscitation should be taught in medical schools and by first-aid training authorities as Professor Woolmer had emphasized.

In order to facilitate this the College undertook to work out a safe and practical method of teaching and group training in the direct method of artificial respiration. It was necessary to overcome the main objections raised by the first-aid authorities. These were: (1) the æsthetic difficulties arising both in applying the method and in teaching it; (2) the problem of communication of disease; (3) the lack of a satisfactory technique for training groups in this method.

[The following training aids were then demonstrated by Dr. Brook:

A documentary film, illustrating the use of mouth-to-mouth resuscitation in a variety of first-aid situations with and without the use of any airway, entitled "That They May Live".

The air passage demonstrator. A wooden model of a sagittal section of the head and neck which enables the demonstrator to illustrate airway obstruction which occurs when the neck is in the flexed position, and the importance of placing the head in the hyperextended position to provide an open airway.

The training manikin. A near-life-size plastic model which enables a first-aid worker to carry out mouth-to-mouth resuscitation on a near-life-size dummy.

The Brook airway, designed to overcome some of the criticisms which had been levelled at other airways recommended for use in mouth-to-airway resuscitation.]

Squadron Leader A. J. Merrifield, R.A.F., said that the Royal Air Force had tried this method on anæsthetized patients prior to surgery An ear oximeter was used for gas measurement, and a continuous CO_2 analyser for end-tidal samples and the pCO_2 of arterial blood was checked by Collier's re-breathing method. Hæmoglobin saturation which had fallen to 75% in apnœic patients was restored to 96% in about eight breaths—almost as quickly as flushing patients with oxygen. End-tidal CO_2 levels varied at $5\frac{1}{2}$% to $6\frac{1}{2}$% and arterial pCO_2s followed this range fairly closely although an arterial-alveolar gradient appeared in most readings. The highest pCO_2 recorded was 50 mm.

Dizziness in the donor appeared to vary with the rate of respiration and not with the effective minute volume.

Teaching presented some difficulty but the film shown by Dr. Brook threw fresh light on some of the problems.

This was a most effective method and should be more widely used in all three Services.

Dr. Michael B. Carson (Southampton) said that one of his responsibilities was to ensure that as many of the Southern Gas Board employees as possible could perform artificial respiration efficiently. They were taught the Holger-Nielsen method, but this particular technique was easily forgotten. Recently he showed some of their first-aid instructors a film borrowed from Dr. J. O. Elam of New York on the mouth-to-mouth method and they were quite convinced that they would have no difficulty in performing it.

Referring to Dr. Brooks' film, Dr. Carson suggested that the Holger-Nielsen method was not performed correctly, and that the differences in the pulmonary ventilation and blood oxygenation in the standard methods of artificial respiration compared with the mouth-to-mouth method might be more adequately displayed. This had been done in another film by Dr. Elam, and the evidence in favour of the mouth-to-mouth method was overwhelming.

Major-General F. C. Hilton-Sergeant (British Red Cross Society) said that expired-air resuscitation (or "rescue breathing") had been under consideration by the Health Advisory Committee of the League of Red Cross Societies. Such methods, however, involved the casualty being placed in the *supine position*—a position which was not recommended for general use by first-aiders attending to unconscious casualties. Regurgitation of stomach contents was a serious matter even for a prepared and completely

relaxed patient on the anæsthetic trolley, with an anæsthetist in charge; it was disastrous for a first-aider with a casualty lying unconscious, face upwards on the ground.

The maintenance of an open air passage in an unconscious person in the supine position might be an easy matter for an anæsthetist; it would be a matter of difficulty for a first-aider and could really only be effectively taught by training selected first-aiders in the anæsthetic room of a general hospital and upon a variety of unconscious patients. Serious injury might be caused to a rescuer's thumb if it was kept inside the victim's mouth to hold up the jaw.

The use of an artificial airway, except by a specially trained expert constantly using such a method, was dangerous and by no means a foolproof undertaking. Disasters were likely to follow its forcible insertion by a first-aider. Moreover there might still be obstruction after it had been correctly placed. Its presence might induce retching, vomiting and aspiration. Another difficulty arises in early asphyxia when the jaw muscles are rigidly contracted.

Rescue breathing required that there should be no leakage of air or the lungs could not be inflated. The possibility and effects of inflation of the stomach required consideration. The transfer of infection was a possibility. Æsthetic considerations and emotional and physical stress on the part of the would-be rescuer were also significant factors. Restoration of the circulation was best achieved by methods of artificial respiration which incorporated muscular movements.

If rescue breathing were to be inadvertently used for asphyxia due to choking from obstruction by some article of food, &c., it would be fatal. In the case of casualties with water, food or debris blocking the air passages the first step to be taken by a first-aider would seem to be to force air out of the lungs, not force air into the lungs.

The above constituted some of the reasons why it was considered, however, that much more investigation was required before any recommendation could be made for the general use of rescue breathing by first-aiders who had been trained in manual methods of artificial respiration.

The first essential of artificial respiration was that it must be started immediately; the use of special apparatus might cause delay. Now that expired air was considered acceptable for resuscitation, it was likely that in special circumstances use would be found for mouth-to-mouth breathing in a modified form.

Rescue breathing by means of ancillary apparatus was quite another matter. Rescue breathing involving the use by non-medical personnel of such apparatus was *not* approved in the United States by (*a*) The National Academy of Sciences—National Research Council, (*b*) the American National Red Cross, (*c*) the American Medical Association, or (*d*) the Boy Scouts of America.

Captain E. Hale, R.N. (retd.), Chief Secretary of the Royal Life Saving Society, a primary aim of which is to teach artificial respiration to the general public and particularly to school children, expressed the view that even though the expired-air method of artificial respiration was shown to be the best method under ideal conditions there were great practical difficulties facing voluntary organizations in the teaching of this method on a widespread basis. Some of these applied particularly to school children. This might mean that the expired-air method would not be properly done and it would lose its advantages over the Holger-Nielsen method which could easily be taught to children of 10. He feared that if the Holger-Nielsen method was condemned by the medical profession the general public would lose confidence in it, the voluntary organizations would cease to be effective in this particular aspect of their work and the net result would be an increase instead of a decrease in the annual loss of life by accidental asphyxiation.

Captain J. H. Stover (U.S. Navy) remarked that he felt the comments of several speakers regarding the "teachability" of mouth-to-mouth artificial respiration were unduly pessimistic. The method was being taught in the U.S. Navy with films. It was his belief that the American Red Cross Society, the U.S. National Academy of Science, and several other U.S. groups did, in fact, approve the expired-air method of artificial respiration and did consider this method the most effective. He pointed out that the comments of Major-General Hilton-Sergeant regarding non-approval by these bodies applied only when the method was practised with ancillary devices such as airways.

Professor Woolmer, in reply, confirmed that expired air resuscitation had been adopted by many bodies in the U.S., and in other countries in Europe, and said that there was abundant evidence that it could be successfully taught. He thought that there was little likelihood of a properly designed airway causing damage, even in unskilled hands. His intention was merely to point out the advantages of expired air resuscitation. It was not for him to say whether, or by whom, the method should be adopted.

Meeting
March 3, 1960

Meeting at the Royal Army Medical College, London

The following cases were shown:

Infected Hydatid Cyst of the Liver.—Lieutenant D. A. Packham (for Lieutenant Colonel S. H. Janikoun).

Hæmochromatosis.—Captain F. J. C. Millard (for Lieutenant Colonel T. P. H. McKelvey).

Thyroid Acropachy.—Captain R. S. Winwood (for Lieutenant Colonel T. P. H. McKelvey).

Heterotopic Pancreas.—Major Kenneth R. Dirks and Lieutenant Colonel T. E. Field.

Macleod's Syndrome.—Captain G. C. Rivett (for Lieutenant Colonel J. MacKay-Dick).

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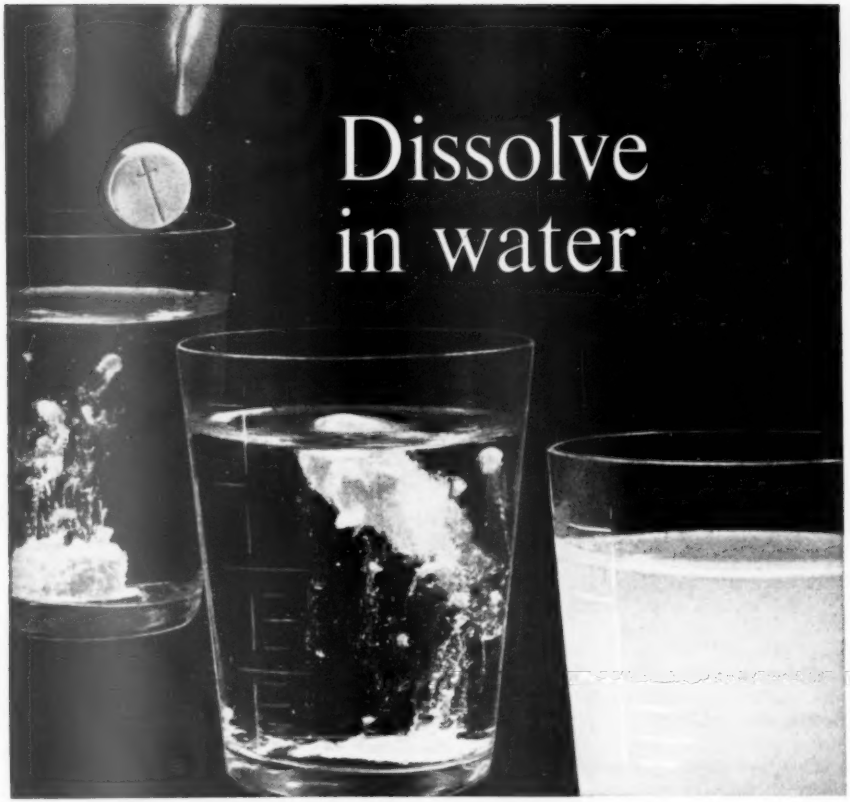

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Section of Pædiatrics

President—Miss ISABELLA FORSHALL, F.R.C.S.Ed.

Meeting
October 23, 1959

A DISCUSSION was held on **The Floppy Baby—Infantile Hypotonia.**

The opening speakers were Dr. JOHN N. WALTON, Dr. A. L. WOOLF and Dr. VICTOR DUBOWITZ.

The papers by Dr. J. N. WALTON and Dr. A. L. WOOLF appear in the *Cerebral Palsy Bulletin*, No. 10, May 1960.

Meeting
November 27, 1959

Extensive Scalds (60% plus) with Survival after Attacks of Bloody Oliguria and Curling's Ulcer.—PATRICK CLARKSON, F.R.C.S.

This is the report of a badly scalded boy who had two serious complications which are seen in severe burns, but are rarely reported as occurring together. Recovery from either complication alone—the bloody oliguria and renal failure, or the Curling's ulcer—is rare.

The patient, a boy aged 2½ years, weight 12 kg, was admitted to the Children's Burns Unit at Guy's Hospital in July 1957. He had fallen into a hot bath while clad only in a vest. His father lifted him out promptly and totally reimmersed him in a cold bath. The scalds affected the trunk circumferentially and adjacent parts of the limbs. None of the affected area was judged to be full thickness in depth. He was cold and shivering with poor peripheral circulation and a blood pressure of 90/55.

He was started immediately on intravenous fluid replacement which, guided by the method of continuous clinical control, worked out at about 15% of his body weight in equal parts of colloid (Dextraven) and electrolyte fluid given intravenously in the first forty-eight hours. During that time he passed only 300 c.c of bloody urine. On microscopic examination this urine showed many red blood cells and granular casts. His blood urea on the second day was 67 mg%. On the third day he passed 190 c.c of urine and on the fourth day 614 c.c. On the fifth and sixth days oliguria was again present and red blood cells and granular casts returned. Glycosuria was present. His blood pressure was 150/100. He was treated (in consultation with Dr. Philip Evans) on a Bull's regime as for an acute nephritis for two or three days. On the twelfth day there was a period of gross hypertension with readings of 270/210 for several hours. The blood pressure was seldom less than 150/100. One period of loss of consciousness with twitching of the left arm and leg was recorded. On the fifteenth day the hypertension was spontaneously relieved.

On the sixteenth day he had a massive melæna, which did not recur.

A month after the accident his urine showed a maximum concentration of sp. gr. 1010. His scalds were healed about three weeks after the accident.

Progress.—During the last two and a half years he has been kept under constant review. His blood urea is now normal; the blood pressure is normal; the urea clearance test is normal. The Addis count (60,000 R.B.C.) is within normal limits. There is no blood in the fæces nor any evidence of persistent intestinal mucosal ulceration. He appears to have recovered completely from the burn and from its effects on the kidney and on the gut mucous membrane.

Discussion.—Sevitt (1957) divides cases of renal failure seen in severe burns into two groups, those with and those without oliguria. He states that "burnt patients who survive anuric renal failure have not been described". It would appear that this boy did have severe renal damage, that in fact he showed renal failure with a bloody oliguria and that he has recovered completely. Bull *et al.* (1950) describe severe oliguria as 300 c.c of urine a day or less, in an adult. His case history would confirm those who believe that the issue in renal failure in burned patients is either death or recovery, and that when recovery occurs from renal failure in burns it is complete. Although no renal biopsy has been done or is contemplated, it would seem reasonable to suppose that there was in the early phases of bloody oliguria both severe glomerular and tubular damage, repair of which is now complete.

It cannot, of course, be certain that the melæna was due to Curling's ulcer. This ulcer (Curling, 1842) nearly always occurs within 2 in. of the pylorus. It is said to be present in up to 10% of all fatal burns (Sevitt, 1957) and that 90% of patients who show evidence of Curling's ulcer (by hæmorrhage or perforation) die. As Sevitt points out Curling's observation of this ulcer was preceded by Swan (1823) and Dupuytren (1832);

Cumin (1823) described gastric congestion in burnt patients. This boy's hæmorrhage, which could have come in fact from any part of the stomach, duodenum, or small gut and been due to multiple erosions or to a single ulcer, occurred on only one occasion. There is no evidence of any recurrence of the gut lesion.

He is presented because of the interest of the kidney lesion, and the evidence it provides that recovery from bloody oliguria in burnt patients can—when it occurs—be complete. It is very unlikely that anyone over 40 scalded to this extent (60%) with these complications would survive. This boy provides further evidence that in fit children (at least in those over 18 months old) resistance to the prolonged severe stress of an extensive burn is probably as high as that in fit young adults.

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Lactosuria and Sucrosuria with Failure to Thrive. —J. A. INALL, M.B., D.C.H. (for J. H. BURKINSHAW, M.R.C.P.).

L. B., female, born 18.4.59, weighing 5 lb 14 oz, of healthy West Indian parents. No relevant past or family history.

She was first seen at 2½ weeks weighing 4 lb 9 oz with a history of persistent vomiting after feeds—lactation was established and she was taking the breast readily.

On examination. — Dehydrated — pyloric tumour felt. Laparotomy (8.5.59) showed minimal pyloric thickening. No other abnormality. Ramstedt's procedure.

Routine post-operative clear fluids taken but vomits soon recurred; little weight gain. Serum calcium (14.5.59) 13·5 mg%. Blood urea 60 mg%. Urine contained reducing substances "neither glucose nor galactose". Lipiodol swallow—some gastro-œsophageal reflux but no hiatus hernia.

Serum calcium (26.5.59) 12·4 mg%. A low calcium diet was given but small vomits persisted, there was moderate constipation, no weight gain, and on 1.6.59 prednisolone 2·5 mg b.d. was commenced.

Weight at 3 months was 5 lb 6 oz; vomiting and constipation continued. Serum calcium 10·6 mg%; prednisolone stopped. Urine contained 1·2 g lactose, 300 mg sucrose and no abnormal amino-acids on paper chromatography.

The diet was changed to Casilan, arachis oil and glucose—excluding sucrose and virtually lactose. The child appeared brighter; vomiting ceased but constipation and failure to gain continued. The urine was free of abnormal sugars (Fig. 1). There was no change when sucrose was added to the diet.

At 4 months, weight 5 lb 8 oz; diet was changed to lactose-free Moll's pudding—Benger's peptonized protein and starches, egg and sucrose. In 48 hours there was a sharp weight gain (*see* Fig. 1) and improvement in general appearance.

In the next five weeks she gained 4 lb, looked robust and was gradually changed to a normal diet. Serum calcium (25.9.59) 9·6 mg%. Urine: free of abnormal sugars. This improvement was sustained and at 8 months the child weighed 15 lb 7 oz and appeared quite normal, readily taking an average diet.

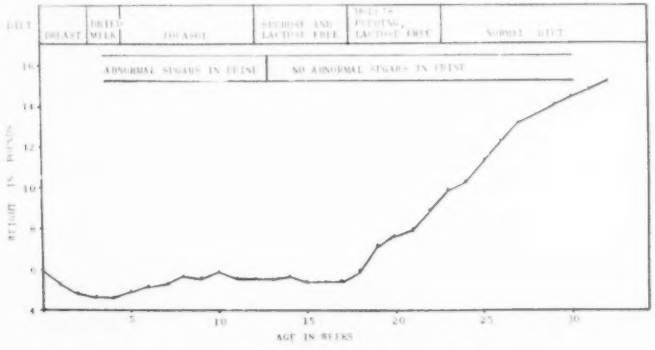

FIG. 1.—Diet changes related to baby's weight and lactosucrosuria.

Comment.—This child showed (1) transient hypercalcæmia, (2) transient marked lactosuria and sucrosuria, (3) four-month period of failure to thrive which ceased when a lactose-free diet with peptonized protein and starches was commenced.

Previous descriptions (Moncrieff and Wilkinson, 1954; Woodruff, 1958) of children with sucrosuria have emphasized concomitant œsophageal abnormalities and mental defect although recently some doubt has been cast on the latter (Perry *et al.*, 1959). These children were under average weight for age and concomitant lactosuria was commonly but irregularly noted. However, only one case seems to have had a truly transient lactosucrosuria (Woodruff, 1958). The child presented shows a type of transient metabolic immaturity which Moncrieff suggested in his series may account for some obscure cases of early failure to thrive.

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Periodic Pyrexia and Erythema Multiforme.—Ronald R. Gordon, M.C., M.D., M.R.C.P., D.C.H.

J. G., female, aged 7 years 9 months (born 27.2.52). Main complaint: periodic bouts of pyrexia since the age of 6 months.

History.—Until 6 months of age she was perfectly normal. She then developed a febrile illness with a rash which was, at first, thought to be measles. She was later admitted to another hospital where a diagnosis of virus encephalitis was made on the strength of the clinical and C.S.F. findings. She seemed to make a complete recovery.

Ever since then she has had recurrent bouts of pyrexia roughly every 21 days. The mother can now detect their onset by the occurrence of pallor, anorexia and lethargy; the fever remains high for three to four days, and then subsides spontaneously. Initially there were no accompanying symptoms or signs but for the past two years there has been associated enlargement of the cervical and sometimes the axillary glands, splenomegaly, a "peffing" type of cough, and sometimes classical erythema multiforme. In some attacks she has had thrombocytopenia, and in some she has had croup.

In 1955 her tonsils were removed.

In April 1959 Dr. I. Sneddon expressed the view that the rash was only one manifestation of a much more generalized disease process.

After her admission to the City General Hospital, Sheffield, attacks were observed on 4 occasions in ten weeks. She had symptoms of fever with a very slight loose cough, enlargement of axillary and cervical lymph nodes, and splenomegaly. A rash, however, was not prominent. As the fever subsided, so also did the other manifestations and her general health improved.

Family history.—Second child; psychologically well balanced but somewhat shy; mother a nurse; no parental troubles.

Investigations.—Mantoux 1/1,000 negative. Brucella skin test negative. X-ray chest normal. Gland biopsy not diagnostic. Bone-marrow showed no abnormality. W.B.C. 5,800 (during an attack) (neutros. 55%, eosinos. 5%, monos. 6%, lymphos, 30%, plasmacytes 4%). The absence of neutropenia was confirmed in other attacks. No glandular fever cells. Hb 10·7 g%. Platelets 321,000/c.mm. Bleeding time and clotting time normal. Urine: no abnormal constituents; no porphyrins; sterile on culture. Blood culture (during fever) sterile. Throat swab: mixed bacterial growth; no hæmolytic streptococci. Toxoplasma: The dye test titre on 27.4.59 was 1/24, on 29.5.59 it was 1/80, and on 1.7.59 it was 1/8. On all three dates the complement-fixation test was negative. The mother's dye test titre on 29.5.59 was 1/14; the complement-fixation test showed a trace only.

Agglutinations: Paul Bunnell less than 1/7. *Salmonella typhi* and *paratyphi* and *Brucella abortus* all less than 1/30. No L.E. cells seen. Plasma proteins: total 7·4 g%; normal electrophoretic pattern of plasma proteins; gamma globulin normal. Cat scratch antigen test negative. The family have possessed only one cat (September 1958 to April 1959) which died from an injury. Other animals kept: one dog (during patient's first year of life) which died of kidney trouble; a rabbit from 1952–1957, which died a violent death; two budgerigars for the past two years. There are no rats in the house.

Virus agglutinations: *Strep. M.G.* < 1/10; influenza A (Sol) and influenza B (Sol) < 1/8; influenza C + 1/8; influenza D (Sendai: Parainfluenza) + 1/128; adenovirus (A.P.C.) group, psittacosis group and *R. burneti* group < 1/8; *Lept. canicola* and *Lept. icterohæmorrhagiæ* negative, 1/30–1/300.

Virus complement-fixation test.—Poliovirus types 1, 2 and 3 not tested. Lymphocytic choriomeningitis (L.C.M.) < 1/4; Mumps (virus particle and soluble) < 1/20; Echo virus type 9 not tested.

Summary.—A child of 7 years 9 months, who had an attack of meningoencephalitis (accompanied by a rash) at the age of 6 months with apparent complete recovery. Since then she has had recurrent bouts of fever every three weeks accompanied in the past two years by (1) cervical and axillary gland enlargement, (2) splenomegaly, (3) loose cough, (4) (sometimes) erythema multiforme; and (5) (occasionally) thrombocytopenia.

So far, neither from the clinical aspect nor the laboratory reports, have we been able to establish a satisfactory diagnosis. Although the basic syndrome is seen often enough in pædiatric practice it is very rare for it to last as long as this, to be accompanied by erythema multiforme and thrombocytopenia, and to occur with its usual rhythm on admission to hospital.

Nutritional Rickets. — S. YUDKIN, M.R.C.P.

A. E., female, born 18.1.58. Aged 22 months.

Brought to hospital aged 18 months because of bowing of legs.

History.—Born at home, birth weight not known. Given bottled milk from birth. Had orange juice, but no vitamin A and D supplement. Would not take solids and had milk only for ten months. Eating some solids now, but still no vitamin A and D supplement.

On examination.—Weight 20½ lb. Marked bowing of legs with maximum bowing at lower end of tibiæ.

Investigations.—X-ray shows healing rickets. Serum calcium 10·8, phosphorus 4 mg%; phosphatase 55 K.-A. units; Hb 53%. Hypochromic anæmia.

Given 5,000 i.u. vitamin D daily.

X-rays showed rapid healing within one month.

Seen by orthopædic surgeon who advises splinting with possibility of plaster cast and manual correction later.

(Dr. Yudkin also showed a boy, aged 20 months, with vitamin-D-resistant rickets.)

Dr. B. Powell mentioned another nutritional case. **Dr. O. D. Fisher** mentioned twins who had come to him in the last week with both rickets and scurvy and **Dr. J. J. Kempton** thought that, with prolonged bottle feeding now being common and the frequent recommendation to use bottled milk instead of dried milk, nutritional disease would become more common.

Dr. Fisher felt that the danger of too much vitamin D had been over-stated, but **Dr. H. Jolly** doubted if people were actually afraid of it. In reply, **Dr. Yudkin** said that there was now very much less pressure in clinics to get mothers to give their children vitamin supplements.

Spleno-renal Anastomosis for Hepatic Cirrhosis with Hypersplenism in a Case of Fibrocystic Disease (muco-viscidosis).—S. D. V. WELLER, M.D., M.R.C.P.

A. K., male, aged 9. Born 2.2.50, only child of healthy parents.

Rectal prolapse from 16 to 21 months. Attended surgical clinic. No treatment.

October 1954: Aged 4. Severe respiratory infection with meningism and heart failure. Fingers already clubbed. Poor response to penicillin, streptomycin and chloromycetin. Slow recovery with Aureomycin. During recovery, stools and duodenal juice negative for trypsin. Antithrombin titre normal. Maintained moderate health with pancreatin and intermittent Aureomycin, but liver remained large and chest was rarely quite clear.

Nose always stuffy and epistaxis started in 1956, becoming troublesome by May 1957, when hæmoglobin was 41%. Nose cauterized in June 1957, with some improvement and hæmoglobin rose to 68%. Liver gradually became harder and abdominal veins prominent. From early 1958 spleen enlarged rapidly, and liver became irregular.

May 1958: Hæmatemesis and melæna. Hæmoglobin 25%. Low platelet and white cell count suggested hypersplenism. Liver function tests (after transfusion): Thymol 2·5 units, serum bilirubin 1·2 mg, alkaline phosphatase 26 K.-A. units, serum proteins 7·1 g, A : G ratio 1 : 1·1.

Further investigations.—Persistent low platelets and W.B.C. count. S.G.O.T. 160 units: S.G.P.T. 110 units.

After a period of three months in bed, with high protein diet and transfusion, S.G.O.T. had fallen to 55 units and S.G.P.T. to 58 units. A : G ratio also improved.

Laparotomy 19.9.58 (Mr. Alan Hunt).—Splenic venogram showed good splenic vein. Portal pressure 500 mm of water. Both kidneys felt normal. Splenectomy followed by tedious dissection to get an adequate length of splenic vein. End-to-side anastomosis with renal vein. Portal pressure then 260 mm and was falling as the reading was taken.

Post-operative recovery very good.

Since then he has had no more hæmorrhages and abdominal veins are no longer prominent. Liver getting smaller. One severe respiratory infection (February 1959). Maintained on antibiotics regularly by aerosol (Alevaire and neomycin) and intermittently by mouth.

Post-operative investigations.—White cells and platelets rose rapidly (both were above average normal in 3 days) and have remained normal.

Transaminase values rose by January 1959 but had fallen again by July, and the A : G ratio had reached almost 2 : 1.

Present condition.—Has been well since March 1959, and has gained 9 lb in this period.

Liver biopsy.—Gross fibrosis of portal areas, but liver lobules hardly affected. Proliferation of bile ducts, distended with pinkish material, and associated with some inflammatory infiltration. No bile stasis. (These findings are typical of the cirrhosis in fibrocystics.)

Discussion centred around the advisability of submitting these patients for operation before hæmatemesis had occurred. In the present case it might have been better not to wait because there was already evidence of splenic over-activity, but most speakers felt that the longest possible delay was advisable so that the child should be large enough for an adequate anastomosis to be achieved.

Idiopathic Hypercalcæmia with Renal Calculi.—C. S. Ayoub, M.B., D.C.H. (for H. M. T. Coles, M.D., M.R.C.P.).

Renal calculi and failure to thrive in spite of treatment are the two features of this case of severe hypercalcæmia of infancy.

The presenting clinical picture in this infant is a familiar one (Lightwood, 1952) i.e., anorexia, vomiting, and constipation in a previously healthy baby at the age of 5 months. The characteristic facies (Schlesinger *et al.*, 1956) were absent except for an intermittent squint, he was hypotonic and had a systolic murmur with a blood pressure of 90. This picture was obscured by a coincidental subdural effusion and the finding of a normal serum calcium early in his illness.

Diagnosis was made on the finding of a persistently elevated serum calcium, a raised blood urea and band sclerosis of epiphyses of long bones. A diagnosis of renal acidosis was at first favoured but an alkali reserve of 26 to 29 mEq/l. and a frequently acid urine ruled this out.

Renal calculi have previously been reported in association with idiopathic hypercalcæmia in a girl of 20 months (Feinberg and Margulis, 1958); she presented with the clinical picture of severe idiopathic hypercalcæmia. We have been unable to find such a case in the British literature although this disorder occurs predominantly in this country. It is interesting to note the rarity of the association of renal calculi and idiopathic hypercalcæmia, a condition which appears to be ideally favourable for the formation of calculi in the renal tract.

The calculus in this case was composed of calcium, phosphate and carbonate. Kidney biopsies (Dr. I. Dawson) showed a few areas of calcification in association with renal tubules, probably of the distal convolution, and small areas of calcification in the interstitial tissue not clearly related to tubules. Otherwise the morphology of the nephron appears normal. Blood vessels are within normal limits.

Histochemical stains (Dr. Pryce Davies) for alkaline phosphatase, acid phosphatase, non-specific esterase, succinic dehydrogenase, lactic dehydrogenase, DPND, fat and glycogen showed no significant deviation from normal.

Response to treatment was slow (Fig. 1). Serum calcium remained elevated for twelve weeks after withdrawing vitamin D, reducing calcium intake to 350 mg per day and giving prednisolone 5 mg per day. Nephrolithotomy (Mr. D. M. Forrest) performed in an attempt to reduce the incidence of urinary infections was

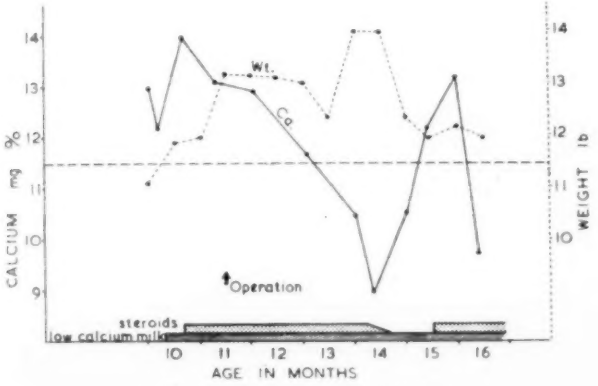

Fig. 1.—Response to treatment.

followed by exacerbation of his symptoms, coma and hypertension. Substituting methylprednisolone for prednisolone did not affect the height of his blood pressure. There occurred coincidentally a severe fall of his potassium and azotæmia. During the three months in which his serum calcium became normal he gained weight rapidly —probably because of water retention as he was clinically œdematous on several occasions. Osteosclerotic changes remained unaffected and no new bone formation could be observed (Lightwood *et al.*, 1957)—if anything, the bony changes were more marked. The degree of nephrocalcinosis was also more marked. Withdrawal of steroids was followed by a rapid weight loss with disappearance of his œdema and a rebound rise in serum calcium in four weeks (Stapleton *et al.*, 1956). Steroids have been reintroduced and serum calcium is falling to normal levels. But again there has been no symptomatic improvement and there is a very poor weight gain.

Over the past two months this infant's urine has tended to be predominantly alkaline with a pH of 9 on occasions. Plasma and urinary bicarbonate and blood pH have been determined (Table I).

TABLE I.—LEVELS OF SERUM AND URINARY BICARBONATE BEFORE AND AFTER SODIUM CITRATE INGESTION

Date	October 27	28	29	3	November 4	5	6
Serum Bicarbonate (mEq/l.) ..	23	22	25	—	25	22	22
Urinary Bicarbonate (mM CO_2/l.) ..	85	72	76	—	97	195	176
Sodium citrate (g)	—	—	—	6	6	6	6
Blood pH				7·28			

At these levels of serum bicarbonate there is an excess excretion of bicarbonate (Pitts *et al.*, 1949) and we have deduced that this child is suffering from a bicarbonate-losing syndrome similar to the condition seen in renal acidosis and which is inducing in him a mild degree of acidosis and accounting for his failure to thrive. We have started him on a sodium citrate, citric acid mixture starting on 6 g of sodium citrate per day and gradually raising the dose. Initially this resulted in an increased urinary excretion of bicarbonate and at the moment there has been some improvement in appetite. Weight gain, however, remains poor.

In view of the fact that renal acidosis has developed over the past few months, we can infer that it is the result of nephrocalcinosis and not a cause of it, as is the case in Lightwood's syndrome (Lightwood, 1935).

This case may resemble the cases described by Stapleton (1954) in which there is an improvement in symptoms in hypercalcæmia on feeding sodium lactate. It also resembles the cases described by Lightwood in which there is concurrent renal acidosis and hypercalcæmia—he suggests that both may be due to the same underlying defect (Lightwood, 1955).

We have been unable to establish any ætiological factors in this child's illness. Vitamin D was not given in excess.

It is interesting to note that this child has a choroidoretinitis with the "pepper and salt" fundus which is said to be associated with intrauterine viral infections. This association may be an interesting one if this condition has been observed in other cases of idiopathic hypercalcæmia of infancy.

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Neurological and Mental Sequelæ of Insulin Coma.—JOHN LORBER, M.D., M.R.C.P., and D. G. H. STONE, M.B., M.R.C.P., D.C.H.

C. S., male, born 30.5.55, was perfectly normal physically and mentally until October 1957 when he developed polyuria, polydipsia and loss of weight. He had started to vomit on November 11, 1957, and lost consciousness before admission to hospital on November 18, 1957. He was then aged 2½ years. He was in deep coma, dehydrated and afebrile; he exhibited generalized rigidity, including neck stiffness, but he had no other neurological signs. He weighed 24 lb. Meningitis was suspected, but his C.S.F. was normal with the exception of the sugar, which was 420 mg%. The diagnosis was now changed to diabetic coma and this was confirmed by a blood sugar of 1,280 mg% on the day of admission at 16.00 hours. His urine was loaded with sugar and acetone.

Treatment (Table I) consisted of 50 units of soluble insulin intramuscularly (approximately 2 units per lb of body weight) followed by 50 units intravenously into a saline/lactate drip (NaCl 5·85 g/l., Na lactate 3·36 g/l.). Three hours later his blood sugar dropped to 900 mg% and six and

C.S. Aged 2½ years.

TABLE I.—TREATMENT

Date	Hours after admission	Time in hours	*Urine* Sugar	*Urine* Ketones	Blood sugar mg%	Soluble insulin (units)	Other treatment and notes
18.11.57	0	16.00	+ + +	+ + +	1,280	50 I.M. 50 I.V. (drip)	Deep coma Rigid Saline/lactate drip
	3	19.00	+ + +	+ + +	900		Coma persists
	6½	22.30	+ + +	+ + +	240		Rigidity and hypotonia alternating Potassium/glucose repair solution in drip
	8	24.00			—	30 I.M.	Can swallow. Oral orange juice 2 oz sweetened hourly for next 11 hours
19.11.57	10	2.00	+ + +	+ + +			Drip as before
	13	5.00	+ + +	+ + +			Clonic movements. Ca gluconate I.V.
	17	9.00			257	30 I.M.	Saline/lactate drip
	22	14.00	+ + +		28		20 g glucose I.V. (more deeply in coma)
	25	17.00	+				Oral K/glucose
	26½	18.45	+		184		

Total insulin in first 24 hours: 160 units or approx. 6–7 units per lb of body weight.

a half hours after starting treatment it fell to 240 mg%. The child remained unconscious with alternating rigidity and hypotonia. His intravenous infusion was now changed to a potassium/glucose "cellular repair" solution ($NaCl$ 1·17 g; K_2HPO_4 0·87 g; KCl 1·49 g; $MgCl_2$ 0·24 g; glucose 50 g to 1 litre of water).

Eight hours after treatment had begun he was still unconscious and was given a further injection of 30 units of soluble insulin intramuscularly. The blood sugar was not determined on this occasion. During the night his intravenous infusion was supplemented hourly by 2 oz of sweetened orange juice given by mouth. He continued to pass large amounts of sugar and ketones in his urine. He remained deeply unconscious and at 5.00 a.m. thirteen hours after admission he developed clonic movements for which he was treated with an intravenous injection of 2·5 ml 10% Ca gluconate. His clonic movements ceased. At 9.00 a.m., seventeen hours after admission and eleven and a half hours after the last estimation, his blood sugar was 257 mg%; he was given a further injection of 30 units of soluble insulin and his intravenous fluid was changed back to the saline/lactate solution. Five hours later he still showed heavy glycosuria, but as he now failed to swallow an intravenous infusion of 5% glucose was started at a rate of 50 ml per hour. At this time his blood sugar was 28 mg%. When this result came through two hours later, he was given 20 g of glucose intravenously in a concentrated solution. This raised his blood sugar to 184 mg%. Subsequently he was never apparently hypoglycæmic during his hospital stay of four months.

He remained unconscious for six weeks. During this time his diabetes was controlled with 20–30 units of insulin daily and he was tube fed. Recovery of consciousness was gradual and it was noted that he moved his right arm and leg, but not the left. Although he continued to improve slowly, he was still unable to sit, stand, feed himself or control his sphincters two years later. For this reason he was admitted to the Children's Hospital, Sheffield, for investigation of his mental and neurological condition.

On examination at the age of 4½ he was a placid and pleasant little boy giving the superficial appearance of reasonable intelligence. Nevertheless, on detailed developmental examination none of his achievements reached the 3-year level and in several respects he was well below that. His mental age of approximately 2½ years was confirmed by Mr. L. B. Birch of the Institute of Education (Terman-Merrill Scales). He was most advanced in speech development, though his speech was dysarthric and repetitive. His face lacked adequate expression, but there were no cranial nerve lesions. There was gross generalized hypotonia and he was unable to sit unaided, but was able to support himself on his right arm. He had an intention tremor, but when he attempted to grasp an object his approach was spastic, particularly on the left side. In spite of the hypotonia his jerks were all present, and the knee-jerks were exaggerated, particularly on the left. His feet were held in the equinus position and the muscles around the ankle-joint were the only exception to the generalized hypotonia. When made to stand up, however, his legs went into typical spastic posture. The muscles mainly affected by spasticity were the glutei, the quadriceps, the calf muscles and the deltoids. He was able to withdraw his right leg on pin-prick, but was not able to withdraw the left, although he obviously tried. There was no loss of sensation. Detailed muscle testing of individual muscles showed fair power on voluntary movement, except for those of the shoulder girdles. Faradic stimulation evoked a typical "spastic" response to minimal stimuli.

Prior to admission and during his first week in

TABLE II.—PERMANENT NEUROLOGICAL AND MENTAL SEQUELÆ OF HYPOGLYCÆMIC COMA IN CHILDREN

Author and year	Age of patient (years)	Prolonged unconsciousness	Neurological sequelæ	Intellectual and psychological sequelæ	Convulsions	Notes
Schleussing and Schuhmacher (1933)	11	10 weeks	?	"Vegetative" existence		Died
Raiha (1936)	12	3 days	—	—	+ +	
Layne and Baker (1939)	8 15	+ +	+ +	Idiot + +	+	
Anderson (1940)	7 13	+ + 4 days	— —	I.Q. 62. Temper tantrums. I.Q. 43	+ +	
Wilder (1941)	8	6 weeks	—	Idiot	—	
Allen and Crommelin (1942) ..	6		Hemiplegia aphasia	Low I.Q.	+	
Murphy and Purtell (1943) ..	11		Hemiplegia aphasia	Retarded	—	
Fischer *et al.* (1946)	"child"	Several episodes		Progressive mental retardation	+	
Gardner and Reyersbach (1951) ..	110/12	Several episodes	—	Conduct disturbance Defect of cognative functions. Fall of I.Q. from 111 to idiocy	+ + +	

hospital he had several spasmodic involuntary movements which sometimes developed into major convulsions, not associated with hypoglycæmia. An EEG showed the typical picture of *grand mal* epilepsy. His fits were controlled with phenobarbitone and his diabetes was managed with 12–16 units of lente insulin daily.

Comment.—In short, this previously normal child went into diabetic coma. During treatment his blood sugar fell precipitously from 1,280 mg% to 28 mg% within twenty-two hours, and it is noticed that the amount of insulin given him during this period was probably excessive (6–7 units per lb body weight). In spite of good subsequent control of his diabetes he remained unconscious for several weeks. Two years later he was grossly retarded, had epilepsy and other gross neurological sequelæ resulting from scattered and asymmetrical cerebral and cerebellar neuronal damage. These sequelæ are likely to remain permanent.

Diabetic ketosis does not appear to lead to permanent neurological or mental sequelæ of the type seen in this patient, nor does prolonged unconsciousness persist after the correction of the deranged carbohydrate metabolism and the restitution of the acid-base balance to normal (Joslin *et al.*, 1959). There is, however, ample evidence that hypoglycæmic coma may well lead to any or all of the sequelæ which were found in this patient. These complications may not only be seen in diabetic patients treated with insulin, but also in persons suffering from spontaneous hypoglycæmia (Malamud and Grosch, 1938) or during insulin shock treatment for schizophrenia (Moersch and Kernohan, 1938). It appears likely that the actual level of the blood sugar is less important than the rate of fall. On the one hand neurological and mental sequelæ may be seen in diabetic patients whose blood sugar level falls very rapidly on treatment, but has not reached pathologically low levels (Conn, 1947; Gegesi Kiss and Barta, 1958). On the other hand prolonged and severe hypoglycæmia may be present without any hypoglycæmic symptoms or neurological sequelæ as occurs in glycogen disease of the liver.

Examples of neurological and mental complications of hypoglycæmic coma in children are given in Table II. The whole subject has been well reviewed by Goodman (1953). He pointed out that the clinical and pathological effects of hypoglycæmia are very similar to those produced by prolonged anoxia, and Gellhorn (1938) has shown that the rate of oxidation in brain cells is reduced in both types of hypoglycæmia and anoxia. Moersch and Kernohan (1938) who studied the pathological features in 2 fatal cases of hypoglycæmia found diffuse petechial hæmorrhages in the central nervous system and considered that the margin between irreversible and reversible must be narrow. At the other extreme Schleussing and Schuhmacher (1933) found huge necrotic areas in the cerebrum of an 11-year-old diabetic girl who died in hypoglycæmic coma. Several other neuropathological studies (Baker, 1938; Jones, 1947; Malamud and Grosch, 1938; Sahs and Alexander, 1939; Terplan, 1932; Weil *et al.*, 1938; Wohlwill, 1938) provide ample evidence of widespread neuronal damage which in the event of survival is irreversible. Widely disseminated areas of multiple petechial hæmorrhages or more extensive hæmorrhages leading to encephalomalacia and cyst formation are commonly seen. These pathological changes are

authoritatively reviewed by Lawrence *et al.* (1942).

In the light of this knowledge it appears undesirable to reduce the blood sugar too quickly in the treatment of diabetic coma or to expose diabetic patients to hypoglycæmia. This is sometimes deliberately done in order to acquaint patients with its symptoms.

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DISCUSSION

Many members took part in the discussion, in which among other details the relative importance of hypoglycæmia and of anoxia, the correct dose of insulin in the treatment of coma were considered.

The possibility of electrolyte imbalance, in particular potassium deficiency, was also raised. In reply it was stated that the serum electrolyte levels had been determined on two occasions during the critical stage and were found to be normal. Nevertheless additional potassium had been given intravenously and by mouth (Table I) because of the well-known tendency to hypokalæmia during the treatment of diabetic acidosis.

Systemic Lupus Erythematosus. — A. A. CUNNINGHAM, M.D., M.R.C.P.

M. P., female, aged 5 years 11 months. Born 19.12.53.

Admitted to Kingston Hospital on 28.5.58, aged 5½, with a history of vague ill-health since 3 years of age. Three months before admission there was a severe "monilial" type infection of the mouth which responded to local treatment, but was followed by severe and persistent limb and joint pain, with joint swelling of the wrists, fingers and knees particularly. The symptoms of general ill-health had persisted with loss of weight.

Family history.—Father aged 24, alive and well. Had tuberculous hip disease as a child. Mother aged 26, has suffered from anæmia and "nerves" intermittently. One sister aged 3, and one brother aged 4 months, both alive and well. No history of rheumatoid arthritis or other similar disease on either side of the family. The home circumstances are very difficult and the family is under the supervision of the N.S.P.C.C. and the local health authority.

On examination.—An ill child with normal temperature, œdema of the face, hands and feet, and "chilblain" type of circulation, particularly noticeable in the hands, even when warm to the touch. Weight 30 lb. There was painful swelling of both hip-joints, both knees, both wrists and all the metacarpophalangeal joints of the hands. The skin of the trunk showed a fine brown pigmentation.

Treatment.—Prednisolone, 15 mg daily, produced a quick response. The child became mobile as joint swelling and pain diminished. Since then, efforts have been made to reduce the steroid therapy dosage. This was reduced to 7·5 mg daily by 23.6.58, but had to be increased again to 10 mg daily on 2.7.58 because of exacerbation of symptoms. Again the dosage was reduced gradually to a minimum of 5 mg daily on 5.2.59, but return of the symptoms necessitated an increase to 15 mg daily by 15.8.59; the dosage has continued at this level. General treatment has included full diet with added vitamins and iron, and antibiotics for infective episodes. There has been complete cessation of growth, however, and the height has remained at 3 ft 3 in. and the weight at 2 st. 2 lb.

Investigations.—W.R., Reiter's test, Rose's test, and Paul Bunnell test negative; Mantoux 1/100 (O.T.) negative. Blood sedimentation rate: 60 mm in one hour on admission, fell to 15 mm by 22.7.58, gradually rose to 110 mm by 23.5.59, and fell to 56 mm in one hour by 14.8.59. Blood counts on several occasions showed only mild secondary anæmia with a hæmoglobin about

75%. Blood chemistry: Plasma bicarbonate 21, chlorides 106, potassium 4·0, sodium 143 mEq/l., total protein 6·4 (albumin 3·4, globulin and fibrinogen 3·0%).

L.E. cells were first demonstrated by incubation technique on 1.7.58. They have been seen on many occasions since then, in spite of continued steroid therapy.

Joints.—The joint swelling has subsided on steroid therapy and there is little disability, apart from slight limitation of movement of both hip-joints.

Skin.—A scaling shiny erythematous eruption developed on the fingers, hands, elbows, knees, ankles, umbilicus and natal cleft with varying accent in different situations related to steroid therapy dosage and to infective episodes. A scaling erythema of the nose and cheeks of butterfly distribution has been noted from time to time. The rash on the fingers has been most persistent and the brownish pigmentation of the skin of the trunk has remained since admission. Ecchymoses have been noted intermittently, particularly on the legs. Pale yellowish plaques involving the skin and subcutaneous tissue have developed and persisted in the upper inner arm and upper chest areas.

Lymph glands.—There has been a persistent small lymph gland enlargement in the axillæ and groins.

C.V.S.—No clinical evidence of carditis. ECG normal on several occasions. On 11.8.59 the terminal phalanx of the right index finger became cold, "blue" and painful. A broad spectrum antibiotic was given, but the condition progressed to typical gangrene on 21.8.59, since when there has been gradual separation of the gangrenous area, complicated by mild local sepsis (Fig. 1).

FIG. 1.

Abdomen.—The liver was palpable 1 fingerbreadth below the right costal margin on admission. In August 1958 it enlarged temporarily to 3 fingerbreadths but gradually diminished to size as on admission.

Renal system.—No clinical evidence of renal damage.

Systemic lupus erythematosus occurs most frequently in young women, occasionally in men. It also occurs in middle age and in children, but if the demonstration of L.E. cells is considered essential to the diagnosis, the number of children with this disease reported in literature since 1948 is very small.

Jacobs (1953) described a 10-year-old child with lupus erythematosus and hæmolytic anæmia.

Krugly (1954) reported 6 cases to the Chicago Pediatric Society, pointing out the protean nature of the disease and emphasizing the effect of steroid therapy.

Bunim *et al.* (1956) treated a 7-year-old girl with a history of febrile episodes extending over four years. From the age of 2 years thickening of the finger nails had been noted and from the age of 3 years she was labelled as suffering from Still's disease. L.E. cells were demonstrated at the age of 7, but the history suggests onset at the age of 3 years or possibly much earlier. There was an earlier history of pulmonary infection and persistent rash dating from infancy.

Zetterström and Berglund (1956) described a group of 11 children treated in Sweden. This series consisted of 5 boys with onset ages of 5–11 years, and 6 girls with onset ages of 7–13 years, the whole series studied between 1952 and 1955. The L.E. cells were only demonstrated in 5 of the 11 cases.

Between 1947 and 1958, 15 patients with onset age under 15 years were closely studied at the Mount Sinai Hospital in New York and reported by Gribetz and Henley (1959) as a contribution to a full monograph on the subject of lupus erythematosus compiled by the staff of the Mount Sinai Hospital. The age of onset in the children's series was 5–15 years with marked preponderance of females (14 females to 1 male). The major early signs and symptoms are clearly and graphically demonstrated.

Skin manifestations were present in two-thirds of the patients. There was a maculo-papular eruption on the trunk and limbs and there were

oral lesions resembling herpetic stomatitis. Some cases had the typical butterfly eruption of the face. Fever was intermittent. Joint involvement was common, but with little tendency to permanent deformity under treatment. Cardiac manifestations varied from ECG changes of myocardial damage to pericardial friction rubs and advanced heart failure. Two-thirds of the cases had renal involvement. The authors thought that the final figure would be closer to 100%, since none of the 5 children free of renal findings had been followed for more than one and a half years. The reticulo-endothelial system was implicated in 80% of the cases. One-third had enlargement of the liver or spleen and one case had jaundice. 6 children had central nervous system signs, including *grand mal* seizures in 2. Several children showed hæmorrhagic tendencies, anæmia was constant, the sedimentation rate was consistently raised and the W.R. was positive in 2 out of 7 cases tested. Of the 15 cases, 6 had died, death being due to cardiac and/or renal failure. Only 3 of the children were in remission, despite the fact that the disease began two and a half, five and eight and a half years previously.

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Congenital Hepatic Fibrosis with Portal Hypertension.—LEONARD HAAS, M.D., M.R.C.P. (for RICHARD H. DOBBS, M.D., F.R.C.P.).

K. L., female, aged 2 years 6 months.

History.—The child was known to have a protuberant abdomen from the age of 1. When medically examined at the age of 2 marked enlargement of liver and spleen was discovered. She was referred to the London Hospital for further investigation.

Family history.—The mother was delivered of a macerated fœtus in August 1959.

On examination.—The child was pale and miserable. The abdomen was prominent and a hard regular liver edge was palpable 4 fingerbreadths below the right costal margin. The tip of the spleen was felt in the mid-line just below the level of the umbilicus, 7 fingerbreadths below the left costal margin. Distended superficial veins were visible on the abdominal wall, the direction of the blood flow being upward. The umbilicus was everted (Fig. 1).

FIG. 1.—Gross enlargement of liver and spleen. Eversion of umbilicus.

Investigations.—Hb 34%, W.B.C. 6,200, normal differential count. Moderate anisocytosis and poikilocytosis of pale staining red cells, platelets plentiful. Bone-marrow not abnormal.

Serum bilirubin 0·17 mg/100 ml. Alkaline phosphatase 10 K.-A. units. Thymol turbidity 14 units. Total plasma protein 8, albumin 4, globulin 4 g%. Barium swallow showed œsophageal varices. Occult blood positive in the stools. Intravenous pyelogram revealed no abnormality.

FIG. 2.—Section of liver showing mature fibrous tissue with interspersed distorted ducts and an otherwise normal lobular pattern (Van Gieson. ×17).

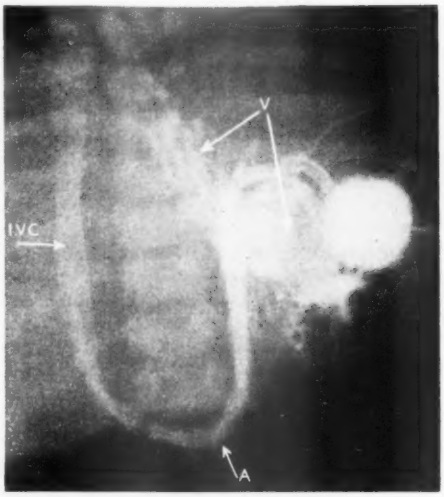

FIG. 3.—Splenic venogram showing abnormal portacaval vessel (A), early filling of inferior vena cava (I.V.C.), dilated varicose gastric veins (V) and absent portal veins.

Liver biopsy.—There were islets of mature fibrous tissue containing distorted elongated and sometimes dilated bile ducts. These areas were clearly demarcated from the parenchymal liver tissue in which the essential lobular pattern could still be seen (Fig. 2).

The histological picture is that of congenital hepatic fibrosis as described by Parker (1956). 4 of his 6 cases had associated polycystic disease of the kidneys but two of his cases are comparable to the case described. These 2 were known to have had enlarged abdominal organs from early childhood. They died of apparently unrelated disorders at the ages of 16 and 33 respectively. They had evidence of portal hypertension at post-mortem.

Portal hypertension poses the main problem in this case. A splenic venogram showed early filling of the inferior vena cava, a tortuous varicose left gastric vein, but failed to reveal any filling of the main portal veins. Thus it appears as though a natural shunt between portal and systemic circulation existed already and it is difficult to see what further operation could improve on this (Fig. 3).

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Mr. H. H. Nixon suggested that the vessel seen on the splenic venogram might be an anomalous splenic vein draining into the vena cava and that the whole of the splenic circulation might not have been outlined. It would be necessary to inject dye into known vessels at open operation to determine its exact nature.

POSTSCRIPT (6.4.60).—Some three months after the child had been shown to the Section, she was admitted to the London Hospital with signs of bronchopneumonia, gross ascites and œdema of the lower limbs. She was treated with Terramycin, chlorothiazide and digoxin, but did not respond and died a week later. Post-mortem examination showed bronchopneumonia and intrapulmonary hæmorrhages. The portal venous sytem was dissected and no extrahepatic block was found. The liver showed severe distortion by fibrosis and irregular cyst formation and for the most part destruction of the normal lobular pattern. The cause of the portal hypertension was therefore considered to be intrahepatic. There were numerous small cysts in both enlarged kidneys, macroscopically up to 1 mm in diameter in the medulla, microscopically involving the cortex as well.—L. H.

The following case was also shown:

Congenital Parietal Foramina.—Dr. GERALD SLOT.

Meeting
January 22, 1960

Neurophysiological Aspects of Cerebral Ischæmia

By G. Pampiglione

London

My investigations have been carried out on children during and after sudden, severe, alterations of cerebral blood flow. Sometimes the circulatory alterations occurred spontaneously, as in patients with cardiac arrest, while on other occasions the interference with the cerebral circulation was deliberately induced during some operations on the heart and main vessels.

In order to simplify the number of possible variables I shall consider the encephalon as if it were a single organ and the blood supply as if it were fairly uniform in various regions of the brain. The brain appears to withstand considerable transitory diminutions in oxygen supply and in arterial pressure without apparent alteration of function. The individual variations are great but there seems to be some critical level below which the cerebral circulation becomes "inadequate".

The "inadequacy" is judged by our ability to recognize that some alteration in cerebral function has taken place. Minor clinical changes are easy to detect in a conscious and co-operative patient but are difficult to appreciate when the patient is anæsthetized or comatose. The study of the electrical activity of the brain may offer considerable help where other aspects of neurological examination are inapplicable.

Our knowledge of cerebral electrogenesis is still extremely limited but empirically it has been possible to correlate some alteration in the electrical activity of the brain with alterations of cerebral function and often with anatomically demonstrable lesions.

The rapidity, degree, and duration of the alterations in cerebral blood flow appear to determine to a large extent the severity of the clinical and EEG phenomena that might follow, as well as their reversibility.

Clinically it is very difficult to predict whether a given patient after a severe episode of cerebral ischæmia lasting a few minutes is going to recover completely in the next few days or whether some permanent cerebral damage has occurred. The present practice of cooling a patient after a cardiac arrest to diminish the severity of the cerebral damage does not facilitate the immediate clinical evaluation of the problem. Moreover the improvements in nursing and anæsthetic techniques coupled with a widespread knowledge of the miraculous effects of cardiac massage are likely to keep alive an increasing number of patients with irreversible cerebral lesions.

It is my hope that EEG studies in patients during and after episodes of cerebral ischæmia may indicate some method, however crude, that might help in an early evaluation of the severity of the cerebral damage.

I shall not enter into technical details but I must emphasize that the use of only one or two EEG channels is likely to offer misleading data. Simultaneous information from a minimum of four or five different regions of the brain appears necessary if any sense is to be made out of a method of investigation which is still in its adolescence.

In Fig. 1 varying degrees of diminution of cardiac output are considered in relation to secondary alterations in cerebral function as measured by EEG. Full recovery may occur after severe, short-lived, cerebral ischæmia but when stage E persists for some hours, an irreversible cerebral lesion has occurred. Although the flattening of the EEG has no definite prognostic significance in the first few minutes following cardiac arrest, when a complete absence of activity in the EEG persists for several hours at a temperature above 30 C no chance of survival appears likely. The brain is dead even if the heart continues to beat.

The duration of cerebral ischæmia is grossly proportional to the severity and duration of the residual clinical and EEG abnormality. There is no rigid scheme, however, for prognosis in the first hour or so after an ischæmic episode with the exception that a rapid and full recovery of the electrical activity of the brain is an indication

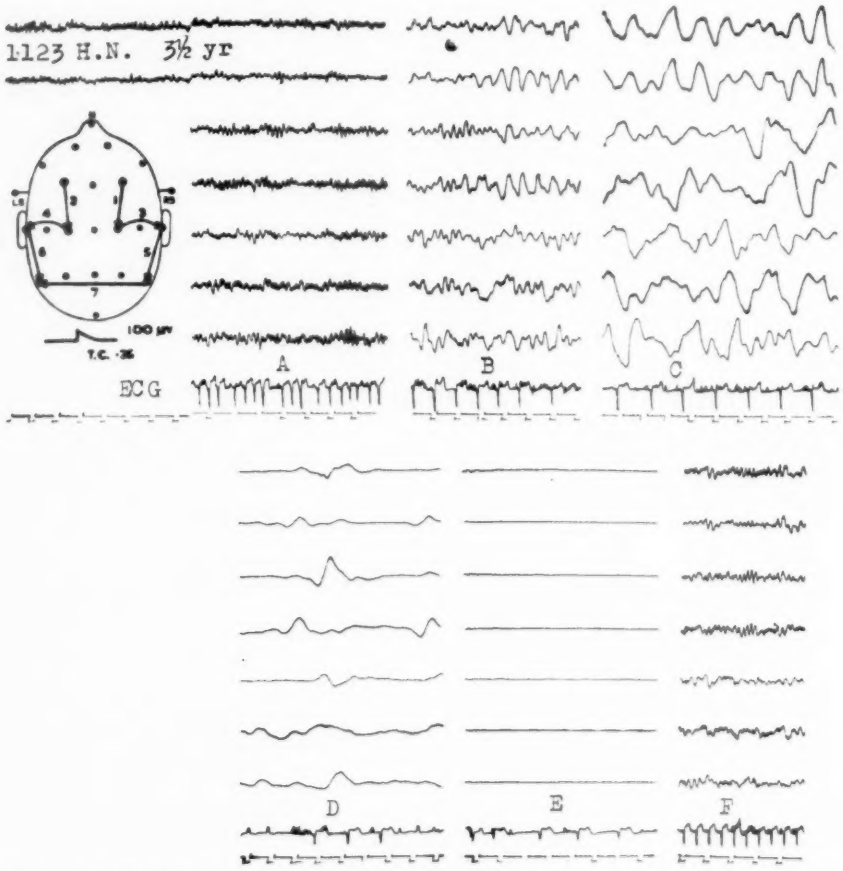

FIG. 1.—A, B, C, D, E: Changes in the EEG patterns in relation to diminished supply of arterial blood to the brain. F: Recovery after cardiac massage and re-establishment of cardiac output.

that the brain has not suffered any irreversible lesion.

Although the arterial supply to the brain is generally considered to be of primary importance, some observations have been made during deliberate occlusion of the venous flow from the brain.

During operations on the heart and main vessels the venous return from the brain is often disturbed. When the superior vena cava had been deliberately occluded for a short period, marked EEG changes often followed. Clinically all the patients became congested and cyanosed in the face and often there was an increase in the size of their pupils. It was difficult, however, to understand why the EEG changes should differ considerably from one patient to another even if some patients became more cyanotic than others.

When the pressure was recorded in the superior vena cava during deliberate occlusions lasting just over half a minute, it was noticed that in some patients the venous pressure increased much more than in others. When the increase in pressure was slow and not very marked the EEG changes were completely absent. In these cases it was found that either abnormal venous channels or a large azygos vein was present high above the clamp allowing a considerable leak out of the superior vena cava system. When, instead, the increase in pressure in the superior vena cava was considerable (perhaps approximating the arterial pressure) the EEG change was definite, occurring in less than half a minute. The EEG

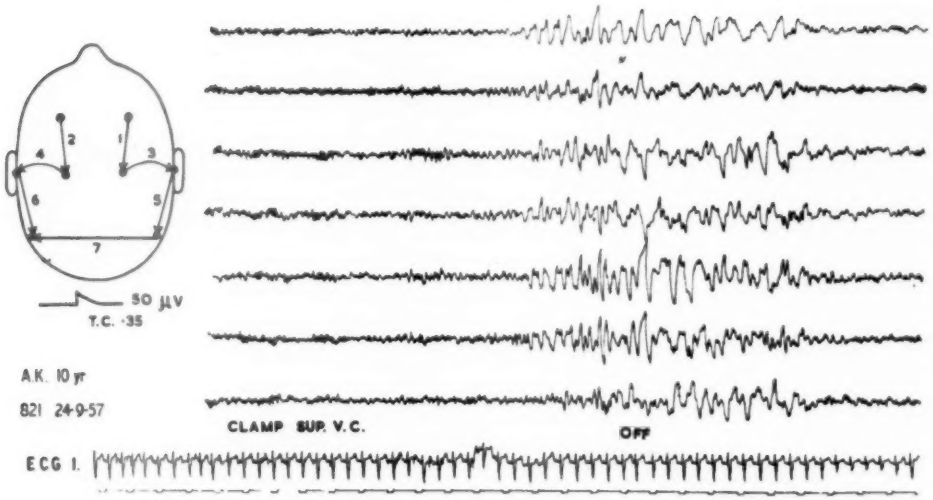

FIG. 2.—Deliberate occlusion of the superior vena cava was followed by a rapidly increasing amount of slow activity in the EEG. The EEG changes disappear soon after the release of the clamp on S.V.C.

change, probably reflecting some alteration in cerebral function, was rapidly reversible after re-establishment of the venous circulation (Fig. 2). The appearance of slow activity in the EEG within half a minute after venous obstruction was not due to a diminution in the amount of blood reaching the heart and later the brain. In fact the occlusion of the inferior vena cava alone without occlusion of the superior vena cava did not induce any EEG changes. And a short-lived or a partial occlusion of the superior vena cava alone was never followed by definite EEG changes. There was no clear difference, either at normal temperature or moderate hypothermia in the delay with which the slow activity appeared in the EEG after superior vena cava obstruction in the same patient.

It seems therefore probable that a venous congestion of the brain may be followed by EEG changes when the increased venous pressure prevents an adequate cerebral circulation.

When the inferior as well as the superior vena cava was occluded, in addition to the venous congestion there was also a lack of supply of fresh blood to the brain. In these cases the EEG after a preliminary increase in slow waves became quite flat. Soon, however, muscle action potentials appeared both from the scalp and from the muscles of the shoulders. On occasions it was possible to notice even clinically that a tonic spasm of the muscles of the head and neck had occurred, sometimes involving even the arms in spite of the curarization, while the patient's pupils became widely dilated. Later the patient might slowly relax while the EEG remained completely flat during the period of cerebral ischæmia (Fig. 3).

After re-establishment of the circulation the patient may remain fully relaxed and, in a few minutes, the dilated pupils become smaller. In the EEG large runs of very slow waves separated by intervals of relative silence are often seen similar to those recorded after a prolonged spontaneous or electrically induced seizure. The flattening of the EEG following obstruction of the cerebral blood flow always outlasted the time of occlusion of the vessels. On occasions the record, in spite of cardiac massage, may remain completely flat for over half an hour before recovery. Sometimes, in the absence of any heart beat and of any respiratory effort with an apparently absent electrical activity from both brain and heart, it was difficult to decide whether the patient should be considered still alive. As yet there are no reliable EEG criteria for encouraging the surgeons or the anæsthetists to continue in their resuscitation efforts or to abandon them in the first hour or so after an ischæmic episode. In fact some of the patients who during cardiac massage seemed to be dead for over half an hour, recovered completely with full intellectual, motor and sensory function by the next day, when the EEG pattern improved very rapidly. When, however, the disappearance of activity from the EEG persisted for some hours none of the patients recovered.

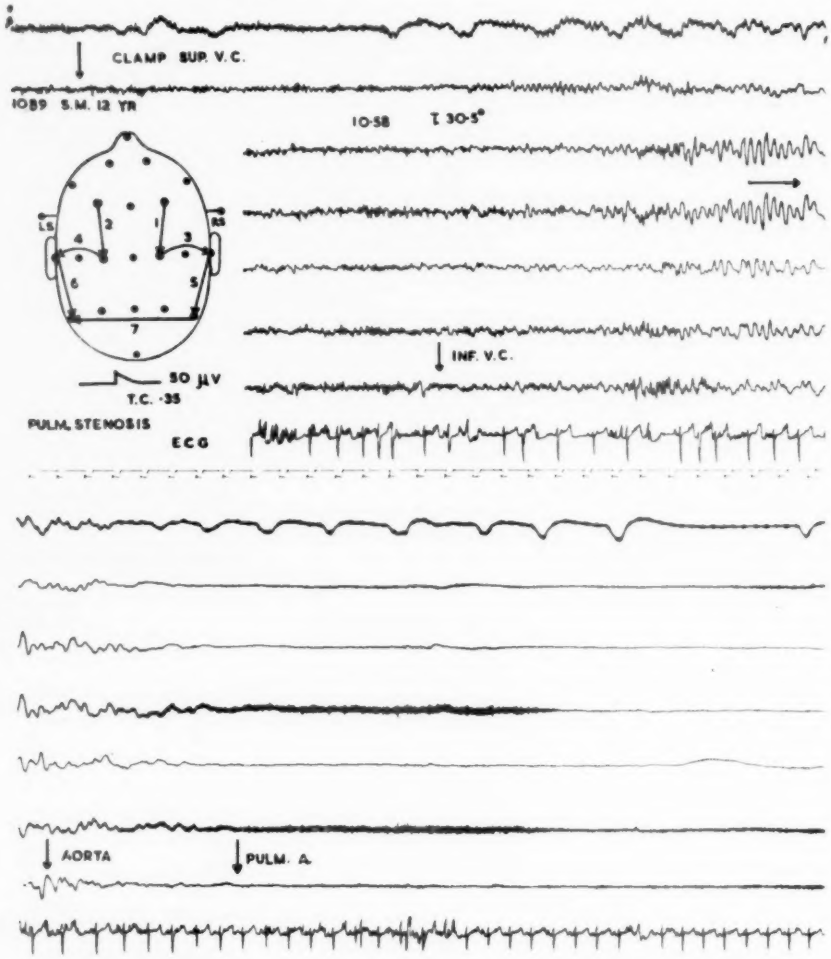

FIG. 3.—Following the occlusion of the superior vena cava and also of the inferior vena cava the EEG becomes flat. Soon muscle action potentials appeared, particularly from the left temporalis during the short-lived spasm. The period of "congestive cerebral ischæmia" lasted only four minutes at a temperature of about 30° C and full recovery took place in less than 15 minutes.

I have avoided the use of the word anoxia in this paper as I do not know whether the oxygen available to the brain is the only important factor in the evolution of the phenomena described.

Acknowledgment.—I wish to acknowledge with thanks the support of the Research Committee of the Hospital for Sick Children and the help of my colleagues, particularly Mr. David Waterston.

The following papers were also read:

The Development of Acid-base Control in the Newly Born.—Professor R. A. MCCANCE.

Eye Changes in Systemic Pædiatric Disease.—Mr. J. H. DOGGART.

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Meeting
January 26, 1960

PULMONARY HÆMOSIDEROSIS

Dr. Philip Ellman (London) [*in absentia* read by **Dr. Audrey Hanson**]:

Clinical and Radiological Aspects

Focal accumulations of hæmosiderin in the lungs are now accepted as the cause of a characteristic miliary deposition seen radiologically and confirmed by pathological examination, and are regarded in the textbooks as synonymous with "brown induration of the lung", which is commonly, but erroneously, supposed to lead to diffuse pulmonary fibrosis.

The condition probably occurs more frequently than is generally thought. The miliary deposition, even of many years' duration, is not necessarily irreversible, and may sometimes even show signs of resolution (Ellman and Oliver, 1959; Doig and McLaughlin, 1948). Where pure iron oxide is deposited in the lung, as in arc welders and silver finishers, there is no evidence of pulmonary fibrosis (Harding, 1945; McLaughlin *et al.*, 1945; Barrie and Harding, 1947).

Diffuse interstitial fibrosis of the lung parenchyma is said to be a feature of idiopathic pulmonary hæmosiderosis (Wyllie *et al.*, 1948), but Ceelen (1931) and Nanciekievill (1949) have shown that in fulminating cases fibrosis is minimal or absent. Dr. K. F. W. Hinson has shown me some sections from a case of idiopathic pulmonary hæmosiderosis where there was minimal focal fibrosis around foci of hæmosiderin but the intervening alveoli were perfectly normal.

In cardiac pulmonary hæmosiderosis Lendrum *et al.* (1950) have shown, contrary to the generally accepted idea, that small foci of intensive connective tissue damage could occur in the region of the foci of iron deposition with some focal fibrosis, but that between these the alveolar walls show a virtually normal appearance. While so many textbooks of pathology and medicine mention diffuse fibrosis he suggests (1959) that this needs review with the assistance of modern histological techniques. In 2 of our cases of cardiac pulmonary hæmosiderosis recently described (Ellman and Oliver, 1959), histological studies did not reveal any significant diffuse pulmonary fibrosis.

Pulmonary hæmosiderosis is the end-result of two main conditions: (1) idiopathic pulmonary hæmosiderosis and (2) cardiac pulmonary hæmosiderosis occurring in certain patients with mitral stenosis and, occasionally, with prolonged failure of the left ventricle (Ceelen, 1931; Laubry *et al.*, 1948; Lendrum, 1949). In 1951 we described the two groups (Ellman and Gee) and suggested that they had certain features in common which justified our regarding the condition as a syndrome. The condition was first noted by Virchow over a hundred years ago (1858) but it was only in 1928 that Rosenhagen described the type occurring with stenosis of the mitral valve, while in 1931 Ceelen described the idiopathic type, unassociated with any cardiac abnormality and based on the study of two autopsies in children with severe anæmia (Ceelen's disease).

The miliary pattern is also the radiological feature of industrial siderosis. I would, however, for the sake of clarity, like to emphasize that in the idiopathic and cardiac cases aggregates of organic iron pigment are deposited in the lung tissues and are, therefore, *endo*genous, while in the industrial siderosis group inorganic iron is inhaled in the inspired air and is, therefore, *exo*genous. Changes in the lungs are not considered prominent features of transfusional and idiopathic hæmochromatoses where, of course, there is a general upset of the iron metabolism which does not occur in hæmosiderosis.

Idiopathic Pulmonary Hæmosiderosis

Wyllie *et al.* (1948) reviewed 24 cases in children and we have outlined its clinical features elsewhere (Ellman and Gee, 1951). Increasingly the disease is being recognized in adults and some 30 cases have now been reviewed in young persons over the age of 16 (Boyd, 1959). Wynn-Williams and Young (1956) emphasize that the disease must be considered in the differential diagnosis of miliary lung infiltrations, especially where fever, anæmia, dyspnœa and hæmoptysis or blood-streaked sputum are prominent features. Scadding (1952) has compiled a list of 83 causes of widespread nodular or reticular shadows in the lungs, and Simon (1956) has related these widely disseminated small circular shadows, varying from pin-point size to 3 mm, to some 25 causes according to the slight variations in their radiographic appearances, which he has then correlated with the more obvious clinical findings. Mistaken diagnoses are indeed possible and Walton and Williams (1951) have recorded one such case diagnosed as acute broncho-

pneumonic phthisis which was disproved by autopsy studies. In the light of present-day knowledge, I must confess that a case I reported as one of streptococcal miliary infiltration of the lungs (Ellman, 1946), referred to me as a case of acute leukæmia and subsequently thought to be a miliary tuberculosis, I now regard as idiopathic pulmonary hæmosiderosis. I have followed this case closely for some fifteen years and since the initial grave and acute episode there has been complete remission for over fourteen years.

Case I.—D. W., female aged 20, was admitted in August 1945, almost moribund, as a case of acute leukæmia. The history was of two febrile attacks a few months earlier, the first accompanied by repeated small hæmoptyses. Three months before admission she noticed increasing fatigue, weakness and pallor. Immediately before admission there was acute dyspnœa, giddiness and palpitation, and a slight cough. She was gravely ill and the lungs were very bubbly. Hb 23%, no signs of heart failure but numerous crepitations heard in both lungs. Chest X-ray showed diffuse miliary mottling in all zones of both lungs but the apices were clear. Sputum examination showed an almost pure growth of hæmolytic streptococci. She was given a course of penicillin and two blood transfusions. Ten days later her lung infiltration had cleared considerably and the blood picture had returned to normal.

The outstanding features of this case were the fever, the profound hypochromic anæmia, dyspnœa and hæmoptysis, and the miliary infiltration seen radiologically. Annual skiagrams show residual punctate mottling in the middle and lower zones, but little evidence of pulmonary fibrosis.

Case II (shown by kind permission of Dr. George Simon).—At the age of 1½ this girl had severe bronchitis and a chest radiograph showed miliary mottling. Later she developed a severe anæmia with a hæmoglobin of 30% and had two transfusions. Splenectomy was performed but no siderosis was found histologically. A lung puncture revealed hæmosiderosis. Now, at the age of 20, she is fit and well. The lung shadows remain unchanged (Fig. 1).

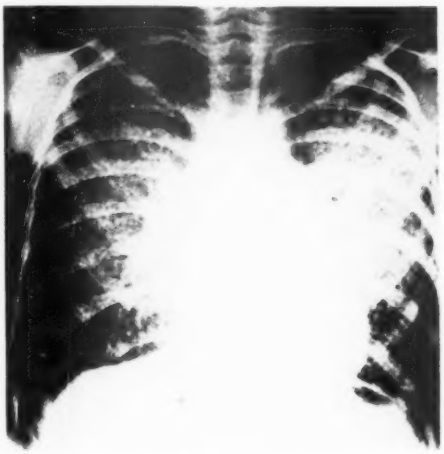

FIG. 1 (*Case II*).—Radiograph of the chest from a case of idiopathic pulmonary hæmosiderosis, showing bilateral miliary mottling mainly in the middle and lower zones, the apices being clear. (By kind permission of Dr. G. Simon.)

The disease is characterized by remission and relapses and in some cases death may ensue from acute cardiopulmonary failure, especially in children. Iron deficiency anæmia is very characteristic. Wyllie *et al.* (1948) have referred to hypochromic micro- or normo-cytic anæmia with reticulocytosis during the acute phase; they regard it as "pseudo-hæmolytic" and secondary to hæmorrhage occurring in the lung tissue. During the acute phase the disease may simulate a respiratory infection, as in my patient. During remissions pallor, lassitude, cough, streaked sputum or hæmoptyses, and clubbing may occur. The finding of hæmosiderin-filled macrophages—often extruded from the alveolar lumina—in sputum and gastric washings is practically diagnostic. Either sex may be affected but in childhood females predominate in the ratio of 3 : 1, whereas in adults, as with the cardiac cases, the proportions are reversed.

I wish to draw attention to a syndrome described by Rusby and Wilson (1959) and Heptinstall and Salmon (1959) in several cases of persistent hæmoptysis associated with glomerulonephritis. In the early stages the pulmonary features were identical with idiopathic pulmonary hæmosiderosis. This syndrome would appear to resemble the rare condition of necrotizing alveolitis with nephritis described by Parkin *et al.* (1955), which I believe is closely related to polyarteritis nodosa, although in both Rusby and Wilson's and Heptinstall and Salmon's cases necrotizing alveolitis was absent and the changes in the alveoli appeared to be the result of hæmorrhage. In idiopathic pulmonary hæmosiderosis the lungs alone are involved.

The radiological findings are those of diffuse punctate miliary mottling, pin-point in some cases, but more widely spaced and larger in others, reaching up to 2 to 3 mm in diameter, with small clear spaces enclosed within the opacities and giving rise to a "pumice stone" appearance. This is particularly marked in the middle and lower zones, with some hilar enlargement, and, unlike the cardiac cases, some resolution of the miliary mottling may accompany the clinical remissions, only to show further aggravation in succeeding attacks. In a case recorded by

Tait and Corridan (1952) there was no radiological abnormality although the typical pathological changes were present in the lungs at autopsy.

Cardiac Pulmonary Hæmosiderosis

This second group occurs in early adult life in cases of rheumatic carditis with mitral stenosis, although Laubry *et al.* (1948) and Lendrum (1949; Lendrum *et al.*, 1950) have also recorded cases in severe failure of the left ventricle indistinguishable from those due to mitral stenosis. We have already recorded 5 such cases (Ellman and Gee, 1951) and have since encountered several more. Four-fifths of the reported cases were in males, and a history of recurrent hæmoptyses or blood-streaked sputum has occurred in my own cases, although I am aware that this is not a constant factor. Laubry's contention that "many cases have hæmoptyses but few have pulmonary hæmosiderosis" should be remembered.

In spite of the striking radiological picture only minimal abnormal physical signs have, as a general rule, been apparent—in some cases wholly absent. In others there may be pulmonary œdema, as with a female patient of mine (Case V) who had no hæmoptysis throughout the whole of her illness. The possible part played by pulmonary œdema in the pathogenesis of hæmosiderosis has been discussed by us previously (Ellman and Gee, 1951). The characteristic miliary mottling in this case was confined principally to the left middle zone, and lung biopsy showed typical heart failure cells. Right ventricular hypertrophy with pulmonary hypertension is common, although not constant.

The radiological lung appearances are characteristic, the middle and lower zones being principally involved and the apices clear as in idiopathic pulmonary hæmosiderosis. The nodules are mainly discrete, dense, miliary nodules, some 1 to 3 mm in diameter, showing a relative central translucency and superimposed over a fine lung reticulation. Although the miliary pattern is remarkably constant over long periods—in one of our cases over eighteen years—some cases may show signs of resolution. The following are three illustrative cases:

Case III.—L. N., male aged 43, first seen in 1939 at the age of 23. He had rheumatic fever at the age of 7 and at 22 he developed exertional dyspnœa and recurrent small hæmoptyses. He had signs of a tight mitral stenosis with auricular fibrillation. The chest X-ray showed gross miliary mottling throughout both lungs, and a mitralized heart shadow (Fig. 2). Mitral valvotomy was performed in 1952. Lung biopsy showed pulmonary hæmosiderosis with thickening of the arterioles but no fibrosis. Post-operatively he was much improved. To date the physical signs in the heart are virtually normal. Radiologically the cardiac outline has returned to normal and there has been very considerable clearing of the lung fields (Fig. 3).

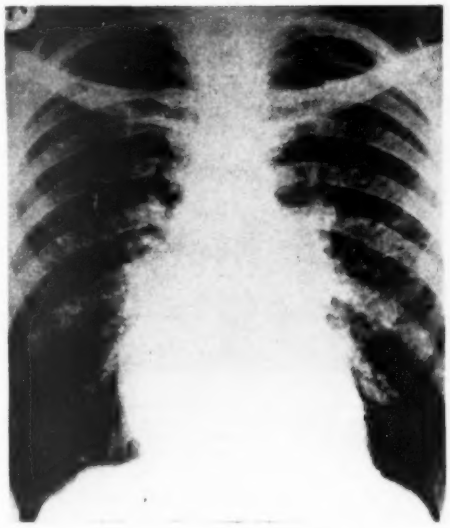

FIG. 2 (*Case III*).—Radiograph of the chest from a case of cardiac pulmonary hæmosiderosis, showing bilateral miliary mottling and mitralized heart shadow.

FIG. 3 (*Case III*).—Seven years after mitral valvotomy showing marked resolution of hæmosiderotic shadows and normal heart outline.

Case IV.—A. B., male aged 41, first diagnosed as a case of mitral stenosis in 1927 at the age of 11. From the age of 24 he suffered from increasing exertional dyspnœa and recurrent hæmoptyses. In 1953, when

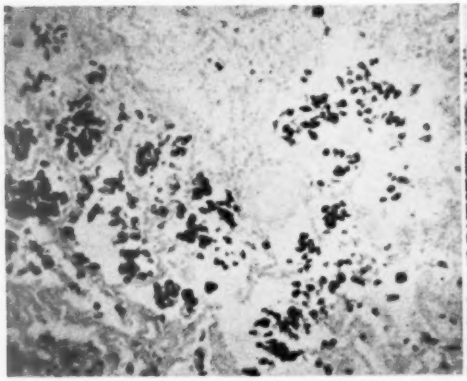

FIG. 4 (*Case IV*).—Section of lung, stained Prussian blue, showing alveoli containing numerous hæmosiderin-filled macrophages, surrounded by normal lung tissue. ×90.

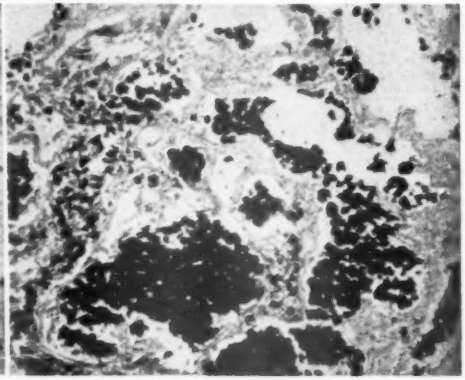

FIG. 5 (*Case IV*).—Section of lung showing some focal thickening of the alveolar walls in the presence of macrophages laden with hæmosiderin. Staining by Van Gieson's method demonstrates that this is due to œdema rather than fibrosis. ×160.

aged 37, he presented with signs of mitral stenosis and aortic incompetence. Cardiac catheterization confirmed a normal pulmonary artery pressure but an abnormally high pulmonary capillary pressure consistent with a severe mitral stenosis. His chest X-ray showed dense miliary mottling in both lungs. Valvotomy was performed in 1954 because of his progressive dyspnœa. He was able to return to work for three years after this. In early 1957 his dyspnœa and hæmoptyses returned and at the end of that year he had a cerebral embolus and died shortly afterwards of acute pulmonary œdema. At autopsy gross calcification of the mitral valves and fibrosis and scarring at the base of the cusps was found. The lung parenchyma was firmer than usual in the upper lobes but the changes appeared to be due to œdema rather than fibrosis. Histologically the alveoli were shown to be packed with hæmosiderin-filled macrophages, giving a strong Prussian blue reaction, but staining by van Gieson's method showed relatively little fibrous tissue in the presence of these macrophages (Figs. 4 and 5).

Case V.—C. D., a woman now aged 31, was found to have mitral stenosis with pulmonary œdema in 1941, following an attack of chorea. She had several episodes of pulmonary œdema during the next few years, each becoming progressively more severe. In 1951 she had increasing exertional dyspnœa, and her chest X-ray showed bilateral miliary mottling, most marked in the left mid-zone. A successful mitral valvotomy was performed in 1952 and a lung biopsy taken at operation showed hæmosiderosis but no pulmonary fibrosis. Since then she has been perfectly well, although there is still a short apical systolic murmur and a low-pitched diastolic murmur. Her chest X-ray is now virtually clear.

Differential Diagnosis

The more common causes of confusion among the many possible causes of miliary infiltration of the lungs are as follows:

(1) *Miliary tuberculosis.*—Here the apices are involved and reticulation is unusual. Tubercle bacilli may be found.

(2) *Sarcoidosis.*—A scalene node or liver biopsy may be conclusive. There may be extrapulmonary lesions in the eye, skin or bones.

(3) *Pneumoconioses.*—The occupational history is very important, especially in siderosis which produces an analogous picture.

(4) *Lymphangitis carcinomatosa.*—A net-like reticular pattern is common radiologically and evidence of a primary growth is usual.

(5) *The collagen diseases.*—Systemic lupus, polyarteritis nodosa and scleroderma show little if any reticulation and rarely any widespread disseminated lesions (Ellman and Cudkowicz, 1954; Ellman, 1956).

(6) *Honeycomb lung*, which includes the xanthomatoses and tuberous sclerosis, is usually associated with general constitutional upset. Very occasionally histoplasmosis and the mycoses may raise additional problems.

In some cases *aspiration lung biopsy*, as shown by Laubry *et al.* (1948) and Ellman and Gee (1951) has been of diagnostic importance. In the 3 cases of cardiac pulmonary hæmosiderosis (Cases III, IV and V) the obvious miliary pattern was present for over eighteen years in Case III, and four years in Case IV. Both these patients had recurrent hæmoptyses. In Case III the radiological pattern disappeared gradually following successful valvotomy and lung biopsy showed no fibrosis. In Case IV, where valvotomy was not successful owing to calcification of the mitral valve, the miliary pattern remained unchanged, and death resulted from pulmonary œdema. At

autopsy the lungs showed heavy focal hæmosiderosis with no significant evidence of pulmonary fibrosis. In Case V the miliary pattern resolved after valvotomy, and again no fibrosis was found in the presence of hæmosiderosis.

It would appear, therefore, that the hæmosiderin deposits, as proved by microscopy, have not produced any significant fibrosis, and that the radiological dispersal of the nodular hæmosiderotic shadows, in a case whose hæmodynamics have presumably been rectified by successful valvotomy, appears to be quite feasible.

From Case II we must also infer that pulmonary hæmosiderosis in mitral stenosis does not contraindicate mitral valvotomy. Moreover, in Case IV, which was followed up for four years, we learn that the focal siderophage collections in a case of hæmosiderosis are not necessarily complicated by fibrosis since no significant fibrosis was present at necropsy. In Case V, with a more localized form of hæmosiderosis complicated by repeated attacks of pulmonary œdema, valvotomy produced complete symptomatic relief with a return to a normal lung pattern. This case was never associated with hæmoptysis.

It would appear that the miliary radiological pattern is mainly due to the focal deposition of hæmosiderin, which, as in arc welders and rouge workers, can be removed from the tissues. Another interesting feature is that it is possible to reproduce the radiological miliary pattern exactly by radiography of a whole lung section after inflation and fixation.

Pathogenesis

The focal accumulations of hæmosiderin in the alveoli appear to result from pulmonary capillary hypertension leading to repeated intra-alveolar hæmorrhages or diapedesis of red cells, possibly from varicosities in the anastomoses between the bronchial vessels and pulmonary arterioles. These, like œsophageal varices, may be difficult to demonstrate, but can be shown by the injection methods which Miller (1947) used to demonstrate the nature of the bronchopulmonary circulation.

I know Professor Lendrum believes that mitral stenosis may not be followed by hæmosiderosis where there is absence of right ventricular hypertrophy and clinical evidence of tricuspid incompetence. It is possible that pulmonary artery hypertension is not a necessary precursor of hæmosiderosis as in Case V, although there the pulmonary capillary pressure was abnormally high.

The possible effect of concomitant tricuspid insufficiency in relieving the back pressure may be the explanation concerning idiopathic pulmonary hæmosiderosis; Cameron (1948) contends that a marked degree of back pressure is taken up by the pulmonary vascular bed before causing any rise in right ventricular pressure.

Steiner (1954) has suggested that the disease can be regarded as an immuno-allergic disease caused by a still unknown sensitizing agent inducing the production of auto-antibodies. He maintains that the antigen-antibody reaction acts in the lungs as a shock organ causing capillary dilatation, stasis, diapedesis, rhexis, destruction of red cells and deposits of hæmosiderin. On this basis he has treated 17 patients with this disease by splenectomy and steroid therapy and claims good results in 5 patients where a follow-up period of eight to eleven years has been possible. He proposes a new name for the disease—"immuno-allergic hæmosiderosis". Steiner's theory merits further study in this country.

Summary

The clinical and radiological features of the two groups of pulmonary hæmosiderosis, namely (1) the idiopathic type in children and young adults and (2) the cardiac group associated with mitral stenosis, have been reviewed.

The supposition that pulmonary hæmosiderosis leads to diffuse pulmonary fibrosis is believed to be no longer tenable. In 3 cases of cardiac pulmonary hæmosiderosis, where histological studies were possible, significant pulmonary fibrosis (focal or diffuse) was absent.

Pulmonary hæmosiderosis associated with mitral stenosis is no contraindication to valvotomy.

Successful valvotomy may be followed by gradual resolution of the miliary lung infiltration.

Sputum examination for siderophores, and aspiration lung biopsy may be useful diagnostic procedures.

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Professor A. C. Lendrum (Dundee):

Pathological Aspects

The deposition of iron in the lung and the reaction of the tissues to its presence was noted as long ago as 1899 (Kockel) and again in 1910 (Bittrolff). That this iron came from the blood was appreciated then; its impregnation of elastica and of reticulin, and the consequent foreign-body cell reaction were all observed, but the belief that the primary change was an unknown damage to the elastic tissue is, I believe, erroneous. No serious attempt was made to relate these changes to cardiac failure, not even by Ceelen (1931) who illustrates a very striking example of siderotic damage in the lung from a man with gross upsets of cardiac function. His interest was apparently mainly in the histopathological changes and their resemblance to those in a group of young people with severe anæmia and gross diffuse pulmonary hæmosiderosis whom he reported at the same time. This condition in young people, which came to be known as anæmizing brown induration, received in the early 1940s the more euphonious term hæmosiderosis previously applied by Sylla (1928) to a curious and far from diagnosed case. In 1946 my colleagues, Dr. L. D. W. Scott, Dr. S. D. Scott Park, and I gave the name hæmosiderosis to the focal collections of siderophores described by Rosenhagen (1928) as occurring in the lung of cases with mitral stenosis, and we noted the radiological similarity with the disease described by Ceelen in young people. Although we knew of, and mentioned (1947), 3 cases of this latter disease we imagined it must be a very rare occurrence, but in 1948 Wyllie and others fully described 7 cases and called it idiopathic pulmonary hæmosiderosis, a name that has been widely adopted in place of Ceelen's hæmosiderosis. It still seems proper with regard to this pulmonary disease to repeat the view I expressed in 1950 "that it would be reasonable to call it Ceelen's hæmosiderosis until such time as we know more of the mechanism".

The hæmosiderosis of more common occurrence is that associated with several different cardiac disorders, and is presumably the residue of intrapulmonary hæmorrhage. Hæmorrhage is but one of various extravasations from the pulmonary vessels that may complicate cardiac disability.

The first of these, hæmorrhage into alveolar ducts, is in some patients converted into focal aggregations of iron-containing phagocytes, the foci being present in such number that they superimpose to give the characteristic radiograph that used to be called miliary congestion, but is now recognized as hæmosiderosis (Lendrum *et al.*, 1950). In necropsy material examined microscopically, I have seen focal hæmosiderosis mainly in association with mitral stenosis, but also now in 5 cases of hypertensive cardiac failure, and one each of pure mitral incompetence, patent ductus arteriosus with obstructed pulmonary vein, syphilitic aortic incompetence, and myelosclerosis in a woman aged 64. Of 8 recently studied mitral stenosis cases, 2 were postvalvotomy; 1 of these survived only a few hours, the other lasted over three years but was never really a success, and microscopy revealed gross siderofibrosis as described below. An interesting feature of all hæmosiderosis cases is the small amount of intra-alveolar and intraduct fibrin, and the lack of evidence of organized fibrin. Thus it is tempting to postulate an active fibrinolysis in these cases, although it may be noted that special staining occasionally reveals within the siderophores solid circular intracytoplasmic bodies that give the staining reaction of fibrin, and raise the suspicion that some so-called intracytoplasmic inclusion bodies may be nothing more than partially dissolved engulfed fibrin.

The change from hæmosiderosis to what may be called siderofibrosis is a gradual one, and as stated earlier (Lendrum, 1950) may be accompanied by the siderotic impregnation of elastica and reticulin, with crystal formation and giant cell reaction, comparable with the changes seen in the splenic stroma in cases of lytic anæmia. In addition to the two previously reported cases, one of mitral stenosis, the other of hypertensive cardiac failure, I have now seen a further 3 cases (2 with mitral stenosis and 1 of syphilitic aortic

incompetence) showing the same destructive and proliferative changes. The same microscopical changes are seen in the later stages of Ceelen's hæmosiderosis, but diffuse rather than focal.

The two points worthy of note here are, first, that spilt blood can be dangerous, a fact that is also exampled in the occasional occurrence of sarcoma in relation to a traumatic hæmatoma (Lendrum, 1948), and this irritative effect seems indubitable, however benign the *inorganic* iron dusts are proved to be by McLaughlin, Harding and Doig. Secondly, the change from hæmosiderosis as a mere collection of phagocytes in ducts and alveoli, through stromal fibrosis to impregnation and giant cell granuloma is one that I do not believe is expressed in the skiagraph. It is probable, however, that siderofibrosis occurs in the lung only when there is so much hæmosiderin present that it will show up on the skiagraph as obvious hæmosiderosis.

Two further exudative phenomena should be noted. The first of these is manifest in the formation of digitate clumps of fibrin in alveolar ducts, commonly seen in the lung of patients dying with uræmia, and most of us willingly accept Doniach's correlation of this with the radiographic butterfly shadows (1947). It is less commonly known that similar clumps may form during periods of cardiac failure in patients in whom there is no reason to suspect uræmia. Possibly related to this in some way is the iatrogenic lesion described by Doniach, the widespread deposition of connective tissue within the ducts and alveoli of hypertensive patients who had received hexamethonium compounds (Doniach *et al.*, 1954); these cases may have some failure of fibrinolysis (Park and Cockersole, 1956), in contrast with the hæmosiderosis cases mentioned above. The persistence of fibrin clumps in cardiac failure cases is a possible explanation of the osseous bodies that occur in the lungs (Lendrum *et al.*, 1950), on the basis of morphological similarity, but transitional stages have not been seen. Despite the statement of Grishman *et al.* (1958) that osseous bodies have been seen only in mitral stenosis cases, I can now report one example in hypertensive cardiac failure, and one in primary pulmonary hypertension.

The third exudative phenomenon may be described as the forcing of fibrinogen into the walls of arteries. This condition, which some years ago I called fibrinous vasculosis (Lendrum, 1955, 1956), occurs in three main forms, differing ætiologically but with a notably similar structural sequence. The three forms can be roughly grouped as the hypertensive, the hyperergic, and the static (as in infarction, strangulation or torsion). What is not commonly realized is that, for example, within *infarcted tissues* vessels can be found that mimic all the various changes seen in *polyarteritis nodosa*, and that the so-called fibrinoid changes of *malignant hypertension* in the kidney may be duplicated in an *infarcted zone* of kidney from a case without hypertension. Therefore, since in the lungs from the cases with mitral stenosis we can presume the existence of some hypertension, it seems quite unjustifiable to regard the vascular lesions as other than the hypertensive form of fibrinous vasculosis. Thus the name arteritis is not really suitable for this lesion, which can reasonably be accepted as malignant hypertension of the lesser circulation.

The clinical implications arising from these studies are rather depressing, and darken prognosis rather than enlightening diagnosis. To summarize: First, in some cases of mitral stenosis and some of remittent cardiac failure (Lendrum, 1949, 1950), there can be the sequence of pulmonary hæmosiderosis, siderofibrosis, incrustation and impregnation with iron, and the consequent deformity of vessels and stroma in iron-granuloma, the appearances that Walford and Kaplan (1957) describe as an "endogenous" pneumoconiosis. Secondly, periods of cardiac failure may leave a residue of organized fibrous tissue occupying the precious air space. Thirdly, the case with high pressure in the pulmonary arteries may be complicated by the onset of fibrinous vasculosis with serious structural effects on the walls of the pulmonary arteries.

All three of these are possible happenings within the lung of the patient with mitral stenosis, whom on radiological findings we have diagnosed as having hæmosiderosis. It is unfortunately not so easy to demonstrate these complications radiologically, indeed it may be impossible, but in assessing a patient for valvotomy we must surely hope that the hæmosiderosis seen in the skiagraph is still the benign occurrence it can often be, and certainly the benefits of operation should not be denied merely because the skiagraph shows hæmosiderosis.

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Dr. A. I. G. McLaughlin (London):

Industrial Siderosis

An important difference between pulmonary hæmosiderosis and industrial siderosis is that the former is caused by organic or endogenous iron, and the latter by inorganic or exogenous iron and its oxides. The link between the two conditions is that both organic and inorganic iron are opaque to X-rays, and when aggregates of them are present in the lungs, the X-ray appearances are comparable.

Siderosis is the oldest of the pneumoconioses, from the point of view of terminology. The term was coined by Zenker in 1866, when at the same time he introduced the word pneumonoconiosis. He described two cases, one a woman who had been engaged in the preparation of blotting paper, by a now obsolete method of rubbing in powdered dry iron oxide ("English red"), and the other a man who had been polishing mirrors, also with iron oxide powder. Both these cases had pulmonary tuberculosis, and it is not surprising that fibrosis as well as iron pigmentation was present in the lungs. However, Zenker came to the conclusion that iron oxide could cause pulmonary fibrosis.

Up to 1930 (Bohrod) thirty cases of siderosis (as a fibrosis) had been described, and these had been divided by Hart (1910) into red and black types. The red type was found mainly in hæmatite and iron ore mining, and the black in grinders and polishers of metals. Both these groups are exposed to mixed dusts containing iron and free silica, and therefore are not examples of pure siderosis.

Stewart and Faulds (1934) showed that hæmatite miners developed sidero-silicosis, often associated with tuberculosis. The silica content of hæmatite varies from one area to another, and in some autopsies on miners from the low-silica area, iron pigmentation has been found without fibrosis (Craw, 1937). The X-ray films in such cases showed widespread nodular and reticular opacities, presumably due to aggregates of iron oxide in the lungs. Experimental work by Carleton (1927), Haynes (1931) and later by Naeslund (1938, 1940) showed that hæmatite dust without silica did not produce fibrosis in the lungs of experimental animals.

The finding of abnormal X-ray appearances in the lungs of electric arc welders by Doig and McLaughlin (1936) was the starting point for intensive studies in various parts of the world on groups of workers exposed to the inhalation of the dust of iron and its oxides. Electric arc

FIG. 1.—Fume clouds, consisting mainly of iron oxide, coming off during electric arc welding.

welders are exposed to the inhalation of blue-grey fume (*see* Fig. 1) which comes off the electric arc, and which is composed largely of nascent iron oxide fume together with some irritating gases, ozone and the oxides of nitrogen. Typical X-ray pictures of welders' siderosis are shown in Figs. 2 and 3 and these show a marked resemblance to the X-ray appearances in hæmosiderosis (without the "mitralized" heart shadow—*see* Fig. 4). They also resemble the generalized nodular picture seen in many other conditions such as silicosis, sarcoidosis and miliary tuberculosis. Indeed, siderosis has often been diagnosed as miliary tuberculosis and I have had, on occasion, to get welders out of sanatorium.

Doig and I have found this picture in a large number of welders, and in few of them has there been disability. Where there has been disability, it has been mainly due to chronic bronchitis and emphysema, which may or may not be occupational in origin. For about twenty years

FIG. 2.—Radiograph of chest, showing well-marked welders' siderosis. The subject, aged 48, is in good health. (By courtesy of Dr. A. T. Doig.)

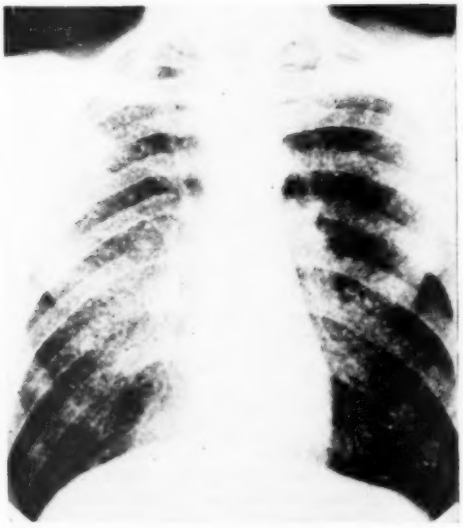

FIG. 3.—Radiograph of chest, showing welders' siderosis. In addition to the widespread nodular shadows, there is a small massive shadow in the right upper zone. The condition was discovered by mass radiography and the patient has no symptoms of ill-health after thirty-six years as a welder. (By courtesy of Dr. J. T. Hutchison.)

we had been on the look-out for autopsies of welders, and we had not found any until about three years ago. This in itself is fairly good evidence that the fume of welding does not do a great deal of damage to the lungs. For a long time the only published account of an autopsy on a welder who had had the characteristic X-ray picture during life came from the United States. It was published by Enzer and Sander (1938) and it is interesting to note that the man had been killed in an accident. Histological studies showed the presence of iron oxide aggregates in the perivascular and peribronchial lymph spaces, but there was no fibrosis in relation to the iron pigment.

Doig and McLaughlin (1948) published 2 cases in which there had been clearing of the X-ray shadows. In one, who had given up welding, there was complete clearing of the shadows; and in the other, who had become a welding instructor and was therefore less exposed to welding fume, there was partial clearing. This man, who was the first in whom the abnormal X-ray appearances had been observed (in 1933), is now 68 years of age. He has no cough or dyspnœa and he works vigorously in his large garden after his day's work. This clearing of the abnormal shadows in welders' siderosis is in marked contrast to what happens in the true pneumoconioses, such as asbestosis and silicosis. In these, the shadows

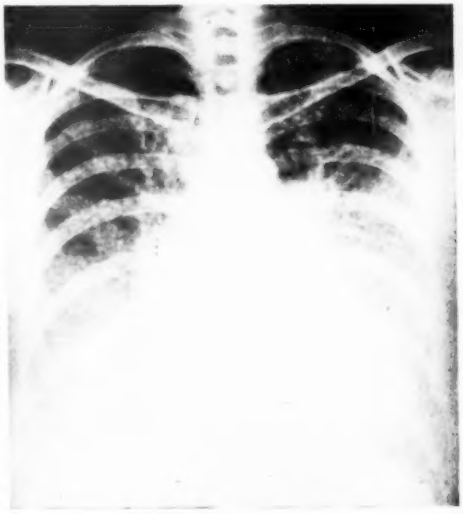

FIG. 4.—Radiograph of chest, showing mitral stenosis and hæmosiderosis. (By courtesy of Dr. L. J. Rae.)

(and the disability) may progress, even if there has been no more exposure to dust.

The statement about clearing of the shadows in welders applies only to those who have not been working in places where they are also exposed to the dust of free silica, as for example, in foundry cleaning shops. Here they are exposed to a mixed dust which contains, amongst other things, SiO_2 and iron oxide, and they develop mixed dust fibrosis of the lungs, which is a modified silicosis. In one carbon arc welder, who had worked for thirty-four years in the castings cleaning shop of a steel foundry, and who had nodular shadows in his chest film, histological examination showed widespread mixed dust fibrosis, with classical silicotic nodules in the hilar glands (Harding *et al.*, 1950).

It must be admitted, however, that a few recent autopsies on welders have shown the presence of slight mixed dust fibrosis, even when no evidence of exposure to the dust of free silica could be obtained. Harding *et al.* (1958) published studies on 5 welders, and 2 of them showed sparse nodules of mixed dust fibrosis, whereas the other 3 did not have the condition. Since the 1930s, the electrodes used in welding have become more complicated, and there is not as much exposure to pure iron oxide as there was. Uncovered electrodes are rarely used now.

In the United States, Charr (1955, 1956) has published histological studies of the lungs of two welders, one from an autopsy and the other from a biopsy. He showed that there was slight fibrosis in relation to the iron pigment in each case. Mann and Lecutier (1957), in this country, found emphysema and loss of elasticity in a right upper lobe, excised because of a tuberculoma, from an arc welder of twenty-five years' experience. They suggest that arc welders' lung is not always an innocent and reversible condition, and that the iron pigment probably caused emphysema.

The results of animal experiments are conflicting, but certainly, as Harding and his colleagues (Harding, 1945; Harding *et al.*, 1947) have shown, pure iron oxide in the lungs of animals will not cause fibrosis. In animal inhalation experiments with welding fumes, it is difficult to separate the effects of iron from the toxic gases, such as ozone and the oxides of nitrogen.

There is some difference in the distribution of iron pigment in the lungs of cases of hæmosiderosis and industrial siderosis. In the former the aggregates of iron occur in groups of alveoli and sometimes lines of siderophores are found marking out the interlobular septa; whereas, in the latter, the pigment is found as aggregates and also as lines in the perivascular and peribronchial lymph spaces. In spite of the difference in the distribution of iron pigments in the pulmonary tissues, the X-ray appearances of the two conditions are similar.

Other Workers Exposed to Iron

Other occupations in which workers are exposed to the inhalation of comparatively pure iron and its oxides include silver finishing (or polishing), the manufacture of electrolytic iron oxide, iron and steel rolling, and iron turning and grinding. Steel and iron melters are also liable to inhale a good deal of iron oxide fume, but these groups usually work in foundries, where there are other contaminants of the working atmosphere. All these workers have shown abnormal X-ray appearances comparable with those seen in welders and again there is little evidence that iron and its oxides alone can cause fibrosis of the lungs.

Silver finishers polish silver articles by rubbing them with a pure iron oxide called "rouge" or "crocus". A similar powder is also used for polishing jewellery. The work is either done by hand, or by holding the articles against a revolving wheel called a "dolly", which consists of many layers of cotton cloth, to which rouge and water are applied.

McLaughlin *et al.* (1945) and later Barrie and Harding (1947) showed histologically that the abnormal X-ray shadows found in silver finishers' lungs (usually of the "pinhead" or "punctiform" variety) were due to aggregates of iron pigment in the perivascular and peribronchial lymph spaces. These workers also inhale some silver dust which was found to produce an intravital staining of the elastic tissue in the walls of the vessels and of the alveoli. Clinically these workers showed no evidence of ill-health, though in 4 autopsies there was found a fine generalized emphysema.

Vigliani (1944) in Italy and Voigtmann (1956) in Germany found comparable X-ray abnormalities in groups of iron and steel rollers exposed to the inhalation of iron scale, without clinical evidence of disability. Buckell *et al.* (1946) found similar X-ray shadows in a group of iron turners and grinders, again without the presence of disability.

Workers Exposed to Mixed Dusts Containing Iron and Free Silica

Some of the most important occupations in which workers are exposed to mixed dusts containing iron and free silica are hæmatite and iron ore miners, iron and steel foundry workers, boiler scalers and ochre millers and miners. All these groups are liable to develop mixed dust fibrosis, but in the stage of simple pneumoconiosis, the X-ray appearances resemble closely those seen in cases of pure siderosis (*see* Fig. 5). It is character-

istic of these groups (and in contrast with cases of pure siderosis) that they may progress to massive fibrosis, with or without pulmonary tuberculosis. There have been many studies of hæmatite miners, notably by Stewart and Faulds (1934; Faulds and Stewart, 1956) and by Craw (1937, 1947).

Investigations of iron ore miners have taken place in Sweden (Bruce, 1942), in Lorraine (Heim de Balsac and Feil, 1934, 1936; Dechoux, 1954) and in Germany (Ceelen, 1951; Symanski, 1955). The presence of free silica in the ore is responsible for the onset of sidero-silicosis in these workers.

The pathology of foundry workers' lungs has been investigated in Switzerland by Uehlinger (1946, 1955) and Rüttner (1950, 1954). Their findings closely resemble those described in this country by Harding *et al.* (1950) and McLaughlin and Harding (1956). Mixed dust fibrosis is a common finding in the various categories of foundry workers, and the severity of the fibrosis varies with the amount of free silica found in the lungs, but not with their iron content. One source of iron oxide in foundries is shown in Fig. 6.

Another point about iron is its possible role as a carcinogen. Campbell (1940) and more recently Richmond (1959) have shown that some forms of iron can cause malignant changes in the lungs of experimental animals. Bonser *et al.* (1955) found 8·85% of carcinoma of the bronchus in 192 autopsies on hæmatite miners, as compared with 1·85% in males in the same locality over 20 years of age. McLaughlin and Harding (1956) found 10% of carcinoma of the lung in 149 deaths in foundry workers. But in foundry work there are more obvious carcinogens than iron, such as tars, pitch, mineral oils and the products of pyrolysis of organic binders in moulding sands. It is clear, however, that more work needs to be done on the role of iron as a carcinogen, and it is possible that certain physical forms of iron and its oxides (and not others) might have carcinogenic properties.

FIG. 6.—Clouds of iron oxide fume arising during pouring of molten metal from an open hearth furnace.

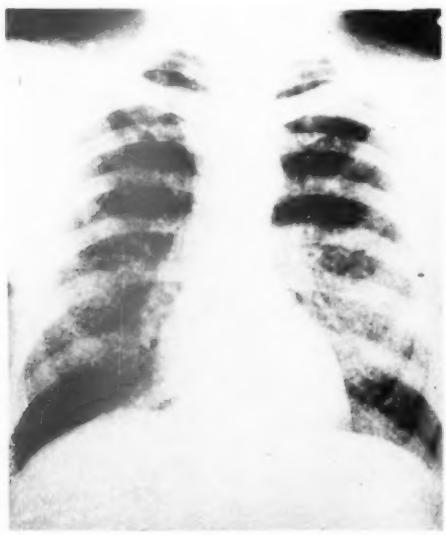

FIG. 5.—Radiograph of chest. An iron moulder, 41 years of age, with mixed dust pneumoconiosis. The X-ray picture resembles that of welders' siderosis, though there are some larger nodular shadows in the right upper zone. (By courtesy of Dr. D. J. Lawless.)

The main theme of this paper is that inorganic iron and its oxides will not cause fibrosis of the lungs. Further, because both organic and inorganic iron are opaque to X-rays, the X-ray appearances of hæmosiderosis and industrial siderosis are comparable.

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Dr. Lloyd Rusby (London) and **Professor Clifford Wilson** (London) showed some examples of idiopathic pulmonary hæmosiderosis in young males which were complicated by the development of glomerulonephritis. A full account of these cases will appear in the *Quarterly Journal of Medicine*.

Dr. R. Arden Jones (Newmarket):

Acute Idiopathic Pulmonary Hæmosiderosis

The 3 cases described below (one kindly loaned to me by Dr. Charles Hay) are the only definite adult cases of idiopathic pulmonary hæmosiderosis which I have seen. In 2 of them there is clear evidence of an inflammatory and hæmorrhagic condition in organs other than the lungs, notably the kidney. This suggests that the disease is in fact a vasculitis and I would like tentatively to suggest that the condition is similar to Henoch-Schönlein syndrome (anaphylactoid purpura) and that this may, in fact, be the pulmonary form of that disease. It would seem worth while to X-ray the lungs in all cases of anaphylactoid purpura and to search carefully for involvement of other systems—in particular the kidneys—in case of idiopathic pulmonary hæmosiderosis.

CASE HISTORIES

Case I was a woman of 33 with a past history of hæmoptysis four and seven years previously. She complained of cough and dyspnœa for one month and hæmoptysis for one week.

X-ray showed heavy miliary shadowing of bat's wing distribution in both lungs. She had a severe hypochromic anæmia, Hb 5·6 g %. There was no evidence of involvement of other systems and blood pressure and heart were normal. She recovered spontaneously but retains a faint reticular shadowing in the lungs. She has had no relapse for two years.

Case II was a man of 28 who gave a three-week history of slight hæmoptysis and dyspnœa. He was found to have a coarse miliary shadowing in both lungs of bat's wing distribution and a profound orthochromic anæmia. Hb 5·4 g %. There was albuminuria and microscopic hæmaturia. Heart and blood pressure were normal. He died in ten days of anoxæmia in spite of transfusions and an oxygen tent.

At autopsy the lung showed extensive alveolar and interstitial hæmorrhage and macrophages containing hæmosiderin. Fibrinous exudate in places had been organized to give a young cellular granulation tissue. The kidney changes resembled those of Ellis type I nephritis in the intermediate phase with proliferative glomerulitis and capsulitis with capsular hæmorrhages and crescent formation.

Case III was a woman aged 63. She had recurrent slight hæmoptysis for two years culminating in a more severe attack associated with dyspnœa in October 1952. X-ray revealed a heavy bat's wing shadowing with some miliary elements in both lungs. Hb 8·4 g %. Heart, blood pressure and urine were normal. The diagnosis was not then suspected and because of spontaneous resolution and cold agglutinins to a titre of 1–250 a diagnosis of virus pneumonia was made.

In 1959 she complained of dyspnœa but denied hæmoptysis and was found to have a severe anæmia, Hb 6·5 g %. There were 6% reticulocytes but serum bilirubin was normal. Extensive rales could be heard in both lungs but X-ray showed only a faint granular and reticular pattern. The heart was normal as was the blood pressure, 140/90. Urine, however, contained much albumin and there was hæmaturia. A diagnosis of pulmonary hæmosiderosis was then considered.

Four months later she died of subarachnoid hæmorrhage, the source of which could not be found at autopsy. Blood pressure normal.

Microscopy showed extensive deposits of hæmosiderin throughout the lungs. In the kidney sections there were glomerular adhesions, crescents and a few recent hæmorrhages into the capsules. The anterior lobe of the pituitary gland also contained a hæmorrhage.

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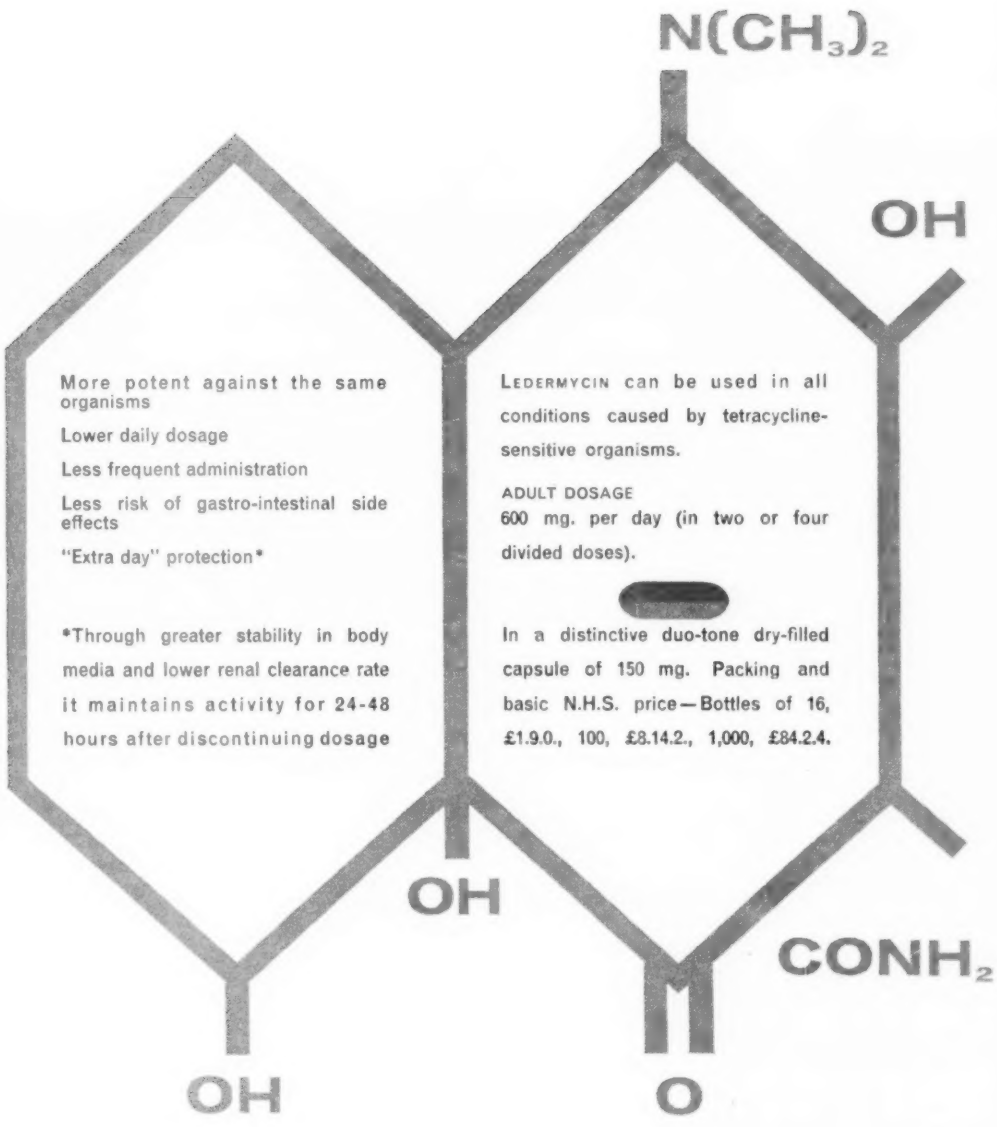

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RK 89

Section of Urology

President—D. S. POOLE-WILSON, M.Ch., F.R.C.S.

Meeting
November 26, 1959

THE following cases and specimens were shown:

Porphyria—a Review.—Mr. J. A. POCOCK.

Renal Case for Diagnosis.—Mr. THOMAS MOORE.

Carcinoma of the Bladder—in a Boy aged 7.—Mr. R. A. MOGG.

Diphallus and Vesicæ Duplex.—Mr. R. A. MOGG.

Combined Congenital and Acquired Stricture of the Upper and Lower Urinary Tract.—Mr. GEOFFREY PARKER.

Utero-vesical Fistula.—Mr. J. MAGRI (for Mr. D. INNES WILLIAMS).

Traumatic Amputation of the Penis.—Mr. D. INNES WILLIAMS.

Ectopic Ureterocele.—Mr. W. G. Q. MILLS.

Retrocaval Ureter.—Mr. B. H. PAGE.

Fibrin Calculus of the Bladder.—Mr. J. C. B. SERJEANT.

Fibrin Calculus of the Kidney.—Mr. A. R. C. HIGHAM.

(1) Retroperitoneal Lipoma. (2) Nephrectomy for Crossed Renal Ectopia with Cortical Abscess.—Mr. J. N. WARD MCQUAID.

Silent Renal Neoplasm.—Mr. A. E. ROCHE.

Sponge Kidney, associated with Cystitis Cystica.—Mr. N. STIDOLPH.

Hæmaturia Due to Renal Angioma.—Mr. S. GLASER.

Bilateral Renal Filling Defects—the Sequel.—Mr. N. SLADE.

Fournier's Gangrene.—Mr. G. N. LUMB (for Mr. N. SLADE).

Meeting
January 28, 1960

Adrenal Apoplexy

A Report of Two Cases

By ASHTON MILLER, M.D., F.R.C.S.

Bristol

ADRENAL apoplexy, or hæmorrhagic infarction of the adrenal, is rare but is worth considering seriously for two reasons: firstly, its rarity means that otherwise experienced clinicians may be unaware of it, and secondly, when it does occur, its diagnosis is urgent because the patient may die if untreated. It is repeatedly stated in the literature that the greatest hindrance to diagnosis is the ignorance of the clinician, an observation with which the author is in complete agreement.

CASE HISTORY

Case I.—A healthy woman of 25, with one child aged 3, had given birth, at home, to a second healthy child four weeks before admission to hospital. Labour was normal but somewhat prolonged, with very little bleeding. Two weeks post-partum the mother developed a thrombophlebitis in the left leg and was treated with penicillin and rest for the limb. By the end of the fourth week the leg was better and she felt and appeared perfectly well. There was then a sudden onset of pain in the left upper abdomen, slight for the first fifteen hours during which she slept for a long period. It then became much more severe and was now felt in the left flank and loin. It was most severe when she altered position and straightened her legs; she described it as "deep inside, a continuous ache made worse by moving and by taking a deep breath". Bowel movement and micturition were normal and did not affect the pain. Slight headache and nausea; no vomiting. Her doctor saw her thirty-six hours after the onset of pain. Temperature then normal, pulse-rate 80. Tenderness and some muscular rigidity in the left upper abdomen; no other abnormal physical signs. He sent her to hospital immediately with a provisional diagnosis of acute left pyelitis.

On admission (7.6.57).—Restless and somewhat pale. Skin hot and moist, temperature 99·8°F, pulse-rate 100, respiration 14, blood pressure 120/70. Respiratory and cardiovascular systems normal. Abdomen not distended; left side rigid with some tenderness in left hypochondrium;

maximal tenderness was, however, in the left loin in the renal angle. Movement of the left leg made the pain worse. Normal bowel sounds were heard. No tenderness in the calf or thigh suggestive of a deep thrombosis; no œdema. Rectal and vaginal examination revealed the uterus about normal for four weeks post-partum. Urine: Protein, trace. 2 R.B.C., 25 W.B.C. No organisms.

It was considered that she might have acute left pyelonephritis, but because she had little pyrexia and nearly normal urine, no great confidence was felt in this diagnosis and no treatment was given on the night of admission. 10.6.57: Temperature still slightly raised, pulse-rate and blood pressure still normal. She complained of pain in the same position in the left upper abdomen and left loin. Again no abnormality was found in the chest. Tenderness remained accurately localized to the left renal angle, but no mass could be felt. Bowel sounds were again normal. Hb 52%, iron-deficiency anæmia and polychromasia. Platelets normal. W.B.C. 5,700, polys. 4,600. Cystoscopy: Bladder normal; a left ureteric catheter was passed easily and clear urine obtained from the left renal pelvis. A retrograde pyelogram showed no dye above the pelvi-ureteric junction. The appearances suggested a perinephric abscess, but no mass could be felt on clinical examination and the general condition did not suggest a septic lesion. The possibility of spinal osteomyelitis was considered, but an X-ray showed no bony abnormality.

11.6.57: Temperature, pulse-rate and blood pressure remained unaltered, but she looked pale and, if anything, more ill. Urine culture: moderate growth of coliform organisms and *Strep. fæcalis*. She still complained of pain which was somewhat more severe but now quite localized posteriorly in the left loin. There was acute local tenderness at this point and obvious muscle guarding on the left side of the abdomen. No abnormal physical signs in the chest; X-ray showed no lung or mediastinal lesion. An intravenous urogram revealed gross distension of the bowel by gas, but it was possible to see secretion from both kidneys at five minutes after injection and to exclude hydronephrosis or other gross abnormality on both sides without demonstrating any detail of the calyces. Blood culture sterile. 12.6.57: Her condition appeared to be deteriorating, but there was still no significant change in temperature, pulse, respiration or blood pressure.

It seemed certain that the cause of her pain must lie in, or in the immediate neighbourhood of, her left kidney. On the findings the most probable cause was considered to be a localized perinephric abscess adjacent to the upper pole of the left kidney. It was therefore decided to repeat the left retrograde pyelogram and to explore the left kidney if there was any doubt about the result. As before, the pelvis failed to fill and the upper ureter showed the same slightly irregular outline. A lateral film showed no anterior displacement of the ureteric catheter which might have occurred as a result of a perinephric abscess, but a persistent scoliosis concave to the affected side was noted in all films. Immediate exploration of the kidney was therefore decided upon. An incision through the bed of the twelfth rib was made and an enlarged congested kidney exposed. The fat in the region of the pedicle was indurated and there was much oozing of blood from everything in the neighbourhood of the kidney immediately it was disturbed. As the upper pole of the kidney was mobilized the bleeding became profuse and was seen to be coming from the region immediately above the renal pedicle where there was a massive hæmatoma. It was impossible to locate any one bleeding vessel, so to obtain more room and because it was thought possible that bleeding was coming from the renal pedicle itself, a clamp was applied and the kidney removed to allow better access. The left adrenal had ruptured as a result of hæmorrhage into it and lay in two widely separated fragments. Several large veins 3–5 mm in diameter led from the adrenal, some passing upwards in the direction of the diaphragm and some downwards to the renal pedicle. The upper leash of veins was ligated and divided so that the attached fragment of adrenal could be removed and then all blood clot was cleared out. More bleeding points were then dealt with until all bleeding had ceased. Two litres of blood were given during the operation and her condition was quite satisfactory at the end with the blood pressure maintained.

Convalescence was uneventful apart from a mild left femoral thrombosis which occurred fourteen days after operation and resolved without incident and without treatment.

The pathological report on the kidney showed it to be normal except that there was a thrombus in the renal vein. The adrenal fragment was also described as normal though vessels in the neighbourhood were seen to contain thrombus.

Progress has since been uneventful.

A number of cases have been described since Goolden (1857) published one of the first examples. There are references to three earlier cases but it has been impossible to verify them. During the last twenty years references to it have become increasingly frequent. One of the best descriptions was published by Keele and Keele (1942) who analysed 10 published cases and found that in 4 the pain was described as below the costal margin, in 5 it was epigastric, while in the other 1 it was in the loin. 4 of these patients had died within twenty-four hours; the others died from thirty-six hours to a few months later. Laparotomy had been performed in 4 cases without the correct diagnosis being made. In all cases death was due to destruction of one or both adrenal glands by hæmorrhage. Keele and Keele observe that this syndrome should be recognizable during life and might therefore possibly be treatable. This observation seemed

reasonable until the second example occurred about two years after the first.

CASE HISTORY

Case II.—A Cornishman aged 29 who had a history of a poor urinary stream for eleven years. Urethral dilatation had been carried out on several occasions for stricture of the urethra, but he developed acute retention of urine which was relieved by suprapubic puncture because instruments could not be passed, and he was referred to us for treatment on 15.6.59.

19.6.59: The urethrogram demonstrated a very severe stricture of the anterior urethra which was negotiated by a filiform guide, but no follower could be pushed through it, so the filiform bougie was tied in for two days and then the stricture satisfactorily dilated so that a cystoscope could be passed. The bladder was grossly trabeculated and infected and a Foley catheter was left indwelling. Intravenous urography showed normal kidneys. On removal of the catheter on 2.7.59, the patient had an almost immediate rise in temperature with rigors and a fall in blood pressure. He complained of pain in the right loin. A provisional diagnosis was made of an acute septicæmia with right pyelonephritis. Specimens of blood and urine were cultured, and an intravenous drip set up containing oxytetracyline because it has been our experience that many of these cases of septicæmia are due to "hospital-type" organisms which are already resistant to streptomycin and several other antibiotics. His general condition improved considerably during the next forty-eight hours and it was obvious that the infection was under control, but he complained all the time of severe, constant pain in the right hypochondrium and loin.

On examination.—Marked rigidity on the right side of the abdomen and tenderness in the right hypochondrium. No variation in normal liver dullness and no mass could be felt. The abdomen was not distended but bowel sounds could not be heard.

The condition remained almost unchanged for another forty-eight hours. He was taking fluid by mouth and passing 1·5 l. urine in the day. He had passed flatus *per rectum* and some bowel sounds were heard although they were not numerous. No tenderness or rigidity in the right loin. Rectal examination normal. Hb 105%, W.B.C. 23,000, polys. 20,000. Blood urea 47 mg%, electrolytes substantially within normal limits. Blood culture 5.7.59: pure growth of *Staph. albus*, coagulase-negative. The same organism was found in the urine.

Although the infection was under control and the patient was passing urine satisfactorily, he was getting rapidly worse and now appeared to be so ill that he was going to die. He had extremely severe continuous pain in the right hypochondrium for which no cause could be found. It was therefore decided to do a laparotomy with the idea that the cause of this pain must lie in the right upper abdomen and might possibly be a perforation; the possibility of a lesion of the adrenal was never considered.

A right paramedian incision was made and on opening the peritoneum a small amount of free blood-stained fluid appeared. Intestines and bladder were normal. A large mass was palpable in the retroperitoneal region on the right side caused by an enormous retroperitoneal hæmatoma. This was beginning to leak into the peritoneal cavity at the root of the mesentery. A right loin incision was made with the patient turned on his side, the hæmatoma opened and 600 c.c of blood removed. The hæmatoma extended around the kidney medially to the root of the mesentery and downwards as far as the brim of the pelvis. The kidney was lying within the hæmatoma and was itself normal. The origin of the bleeding was the adrenal gland which, as in the previous case, had ruptured following bleeding into its medulla. As there was no continued bleeding after the hæmatoma had been evacuated the wound was closed with drainage and the patient made a quick and uninterrupted recovery.

In Case II all the signs and symptoms were related to the peritoneal cavity and it is easy to understand why many patients have had a laparotomy performed without the correct diagnosis being made. If the retroperitoneal hæmatoma had not been very large it is quite possible that it would have been overlooked.

Arnaud (1900) described three clinical types of this condition in adults: (1) A "peritoneal" type in which abdominal pain with or without vomiting is the predominant symptom. (2) A type characterized by asthenia progressing to death. (3) A type in which a patient suddenly passes into coma which deepens until death occurs in a few hours. A fourth type was described by Levenson (1908) in which sudden dramatic death occurs for no obvious cause. All these types have been found at autopsy to have hæmorrhage into one or both adrenals as the only significant finding. A small minority of cases have been unilateral and it has been more common on the right side. In all cases in which autopsy was performed, the adrenals were replaced by blood clot either within a capsule or spread out in the retroperitoneal region. A palpable tumour of the loin was reported in only one case.

Small multiple hæmorrhages may be found in the glands, or there may be hæmorrhage into the medulla with the cortex intact and ballooned, or the cortex may rupture as a result of a massive hæmorrhage. Presumably some mild cases occur and recover without the diagnosis ever being made, and presumably an odd one survives with the formation of an adrenal cyst as described by Falconer (1953), or they may become victims

of Addison's disease. The majority undoubtedly die more or less quickly with the diagnosis unmade. There was only one recorded case of a correct diagnosis during life (Foster, 1920).

If we can remember that the condition exists then treatment may be possible. Where shock and collapse are the main features, both adrenals are involved and cortisone should be given. In the other variety, in which severe pain without shock is the feature and in which the lesion must be unilateral, surgical exploration is usually necessary and cortisone may be needed if the condition is of long duration.

The first reported patients who recovered following treatment were those of Edelman (1945) and Oddo (1946); there have been a few others since.

The mechanism of the condition is unknown though the immediate cause would seem to be thrombosis in the adrenal veins. Where pregnancy is involved it is easy to suggest that involutional changes may be responsible for the thrombosis, but pregnancy has been a factor in a minority of the published cases and, therefore, there must be some other mechanism. The proven septicæmia in Case II suggests that the condition in adults may sometimes have the same ætiology as those in childhood which have been described under the name of the Waterhouse-Friderichsen syndrome—a fulminating infection involving the blood stream.

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The Hazards of Diathermy in Urology

By J. P. MITCHELL, F.R.C.S., and G. N. LUMB, F.R.C.S.
Bristol

Mr. J. P. Mitchell:

Urologists depend to a much greater extent on the surgical diathermy apparatus than specialists in other branches of surgery. Consequently, the hazards of a diathermy burn are even greater, not only because of the increased risk of incidence, but also because of the increased severity of the burn due to the duration of use in any one operation.

For the purpose of this paper I intend to concentrate on one hazard of diathermy, namely the electrical burn. This has been encountered by all urologists at some time or another, but the examples quoted have been collected from various centres, and not all in urological clinics. Some instances have been recounted secondhand and others have been gleaned from the investigations of legal defence societies.

The diathermy machine was for many years a simple spark-gap oscillator controlled by one dial and two switches. There was little to go wrong and little chance of human error. However, the control panel of the latest combined valve and spark-gap assembly has no less than 8 dials, 8 terminals, and various indicator lamps, fuses and switches.

Whether a spark-gap or valve oscillator is used makes little difference to the principle of the circuit. Earthing is of the utmost importance on both sides of the transformer. On the main input side earthing is via the three-pin socket, but on the high tension or output side earthing should be to the indifferent electrode or plate. Certain accidents have occurred in recent years through reversing the leads on their terminals, one of which used to be marked "P". For this reason the Ministry recommended different terminals so that the lead plate can then be connected only to the earthed terminal. The need for this modification of the diathermy terminals has been made more necessary by the introduction of anti-static rubber, which in itself gives some earthing to the patient. Very often the indifferent electrode lies in contact with the anti-static rubber, hence both must be on the earth side of the circuit. Beyond this risk of reversing the leads, which has now been safeguarded, faults in the machine itself cannot produce a burn.

It has been suggested that the anti-static rubber is a sufficiently good conductor to earth for us to be able to dispense with the indifferent

electrode, and certainly the fulgurating button or resectoscope loop will work, but it is leaving too much to chance. The earthing qualities of the anti-static rubber pad can vary from one part to another, and there could be a localized concentration of current resulting in a burn.

The source of diathermy burns can be traced to one of four faults: (1) Insulation of the patient; (2) leads and terminals; (3) application of the plate; and (4) footswitch activated unwittingly.

The first and commonest cause of burns lies in faulty insulation between the patient and the operating table. The operating table is earthed by its contact with the floor, which is a sufficiently good conductor for the high frequency current used, with the result that the current more readily passes via this route, making what is termed a monopolar effect.

Many earthing errors are obvious such as a leg touching naked metal stirrups, or a hand coming into contact with an exposed metal arm-rest. When a Mayo instrument tray is used, the operating table can be elevated so that the patient's shins just make contact with the undersurface of the Mayo stand. The protection against all these faults is rubber insulation on the operating table attachments. Leg stirrups can easily be covered by wide-bore rubber tubing, and it seems strange that this simple precaution is not observed by all instrument manufacturers.

A further, but less obvious, fault in insulation may occur when the rubber pads on the operating table become parted, for instance when the patient is moved up or down the table, so that only the canvas remains between the patient's skin and the metal of the table top.

When the diathermy current is on and the patient is touched by someone with bare hands who is already earthed, it is possible for the diathermy current to short through the second individual, and it is also remotely possible for both the patient and the person touching him to sustain a tiny burn from the spark that passes through the point of contact. This has been known at times to arouse the anæsthetist abruptly. Six years ago one such anæsthetist (Atherstone, 1954) complained that the diathermy machine always shorted through his skin. He blamed inadequate earthing of the diathermy, but he was probably bridging the current from the patient to the metal of the operating table or even the metal of his own anæsthetic trolley. It is possible also that he may have failed to change his outdoor shoes, making himself an excellent earthing conductor on a wet theatre floor.

Before leaving the first group of faults, namely failure of insulation of the patient, it is necessary to point out that the current will always pass by the more direct route of less resistance. One burn occurred when a testis was undergoing operation for hydrocele. The testis had been lifted from the scrotum and was resting on the patient's thigh. There had evidently been a fair amount of bleeding from the cut edges of the tunica, which had been thoroughly coagulated by diathermy. When the testis was replaced in the scrotum a burn was found at the point of contact with the thigh. Presumably there was a more direct and moist contact with the thigh than the cross-section area of the cord, hence the current chose the skin route in preference to the spermatic cord.

A fault in the lead itself where the insulation is wearing thin or is cracked may result in a burn. When terminals are not adequately secured and become separated or actually break away from the lead plate, a current shortage can occur. Corrosion of the terminals could produce a similar effect by insulating them from the plate. Towel clips are often used to hold the diathermy lead in position and it has been known for the points of the towel clip to puncture the lead and burn the skin beneath the towel. Fig. 1 shows

FIG. 1.—Burn caused by the points of a towel clip.

a burn caused by the points of a towel clip which had been in contact with a faulty terminal. It was found that the male terminal did not fit completely inside the socket, leaving $\frac{1}{8}$ in. exposed (Fig. 2). The edge of the towel clip had slipped into the gap and made contact.

The surgeon's own skin is not immune to the risk of a diathermy burn and we can all recall the painful indication that there is a perforation in the glove. It is not unknown for an operator

FIG. 2.—The towel clip making contact with a faulty terminal.

inexperienced in the use of the resectoscope to burn his nose from contact with the exposed metal of the instrument.

A light lead taken from a transformer earthed in common with the diathermy circuit can blow the bulb of the resectoscope as a result of a surge of current immediately the diathermy footswitch makes contact. To avoid this the light lead must be transferred to a battery when the diathermy is in use. However, a spare light lead can be dangerous. On one occasion, two light leads had been used, one to the earthed transformer to light the cystoscope and the other to the battery. Fig. 3 shows a mock-up of the incident. Having finished the cystoscopy, I left the light lead dangling. When I started resection I heard a faint sizzling on the surface, where the loose lead was in contact with the skin of the penis. This bare terminal of the light lead was acting as an earthing point in preference to the lead plate. Fortunately the burn was no more than a pinpoint and healed fairly quickly.

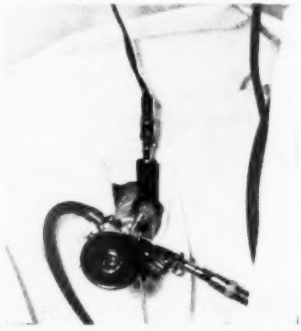

FIG. 3.—A loose cystoscope light lead dangling in contact with the glans penis.

The most important feature of all is the preparation and application of the diathermy plate. This is usually made of lead and should be as flat as possible. Any irregularity in the surface of the plate can give a concentration of current, either through a ridge or through a turned up corner. An even contact with the skin over the whole surface is best made by covering the plate with a towel soaked in strong salt solution. Sometimes the plate is applied with a smear of soft soap over the whole surface, in which case the smallest irregularity in the surface of the plate will concentrate the current. Furthermore, the terminal, by its bulk, makes a deeper impression in the skin than does the rest of the plate and hence, possibly, an area of reduced resistance. On the whole it is safer to use towelling, but a constant thickness is essential which may not occur if the plate is not fully covered by the first turn of towel. It should be left evenly damp and creases must be avoided, as these will be squeezed dry by pressure quicker than the rest of the pad and areas of high resistance created. The terminal is a particularly dangerous point as it can become exposed. A burn resulting from creases in the towelling which had been too dry is shown in Fig. 4.

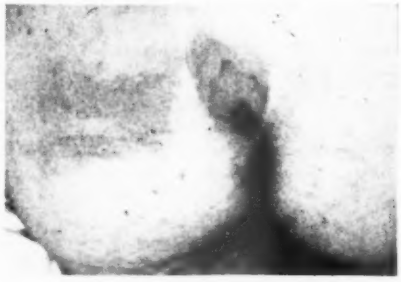

FIG. 4.—A burn which resulted from creases in the towelling which had become too dry.

Increased resistance occurred and the diathermy current had been turned up to overcome it. The impression of the terminal can also be seen.

It is a golden rule that an inadequate current from a machine set at its usual readings on the dials means a fault somewhere in the circuit.

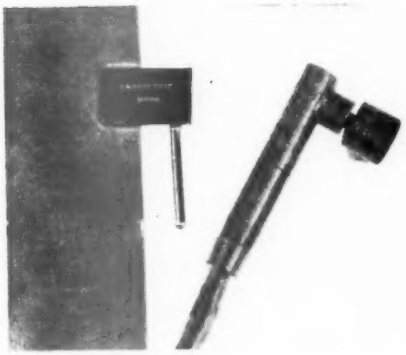

FIG. 5.—Diathermy plate with male terminal, and its lead fitted with an insulated female terminal. The lead is covered by a double layer of insulation of which the outer layer is transparent.

It is always dangerous to turn the machine up beyond its usual setting to obtain the power required.

Points where bone is near the surface, as on the front of the shin, should never be used for a diathermy plate. I witnessed one such accident, which was fortunately spotted before the burn was more than a superficial reddening, because the surgeon had become suspicious when the current seemed inadequate with the dials at their normal setting. It has been stated that the danger, where bone is superficial, is due to increased conductivity of bone. However, the more likely cause is the sharp bony surface making an uneven contact with the plate.

Fig. 5 shows the form of diathermy plate and lead in use in Bristol (Mitchell, 1960). In this type the plate has the male terminal and the lead has the female terminal which is completely insulated. If the lead comes adrift from the plate then there is no exposed portion to transmit the current, the whole of it being covered by insulating material. The lead has a double thickness of insulation from its terminal for a distance of about 1 ft (30 cm), the outer layer of insulation being transparent so that any fault occurring in the end of the lead can easily be spotted.

Figs. 6–9 show the routine adopted for covering the indifferent electrode. A yard (1 metre) length

FIG. 6.

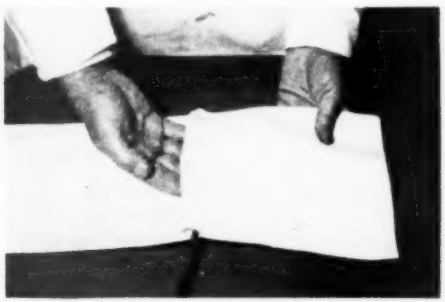

FIG. 8.

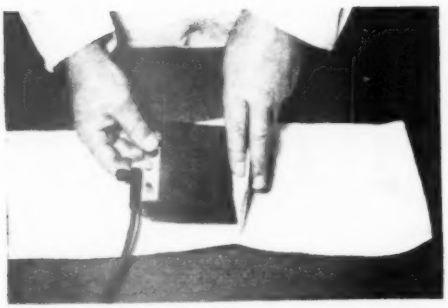

FIG. 7.

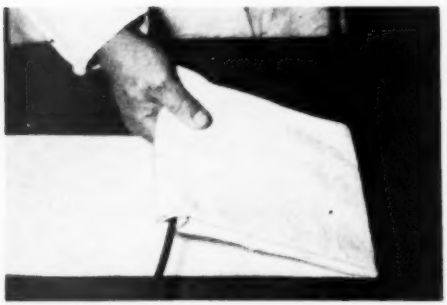

FIG. 9.

FIGS. 6–9.—Routine for covering the indifferent electrode.

of narrow towelling is fashioned with a pocket at one end into which the plate fits snugly. The pocket has a flap which is turned in to cover the terminals. Then the rest of the towelling is folded over evenly.

The site of application of the plate varies with choice. Under the buttocks can cause drying of the towelling from the patient's own weight. On the thigh may cause the operator difficulty in endoscopic work by restricting his movements. Some urologists choose the abdomen and rest the plate on the front of the abdomen covered with a layer of rubber sheet for insulation. A burn found after the towels were removed on one such occasion is illustrated in Fig. 10, and Fig. 11 shows a "mock-up" of how the burn is believed to have occurred. A pair of scissors slipped under the sterile towelling and the handles made contact with the diathermy plate beneath its rubber sheet, while the blades were on the skin.

FIG. 10.—A burn due to a pair of scissors under the towels in contact with the indifferent electrode which had been placed on the abdomen.

FIG. 11.—A "mock-up" of the accident producing the burn in Fig. 10.

An uninitiated assistant who either forgets to take his foot off the switch pedal or treads on it accidentally to rest his limb can also be responsible for a burn. One such accident occurred while the diathermy needle was resting in its sheath and the burn gave the complete impression of the towel clip and sheath. These accidents can be avoided by the surgeon always taking the responsibility of the foot switch.

The medico-legal aspect must be considered. Puzzling as the origin of some burns may seem, there is no escape from the verdict of neglect. Counsel for the defence has been known to contend that the diathermy machine was at fault and resulted in the accidental burn of the patient, but the manufacturers can be exonerated from this censure. A defect in the diathermy circuit could give the patient a shock, but a burn can only result from a fault distal to the machine.

As with most electrical burns they are always deeper than they appear at first sight, and if there is any blanching of the central area immediate excision of the lesion is the best treatment and will result in the quickest healing. The site of the burn rarely precludes this method of treatment.

Finally, I have heard the statement made that diathermy burns are liable to occur even in the best-regulated theatres, but such complacency is quite unjustified, even if only one burn occurs in several years. A drill is advisable and should be adhered to rigidly and it is the surgeon's responsibility to be constantly on the watch for any breach of this discipline. Every nurse should receive definite instruction in the use of the surgical diathermy.

In one case a diathermy burn was not noticed until the fourth day after operation. The patient was advised to have it excised the following week. This she agreed to and it was done on the eighth post-operative day. Forty-eight hours later, she died suddenly from a pulmonary embolus which was confirmed at post-mortem. Although this must almost certainly have arisen from her original operation, I am sure that the relatives believe that her death was due to some surgical error at the second operation which was only necessitated by virtue of the accidental burn. The patient should never leave the theatre after diathermy has been used without inspection for possible burns, with

particular attention to the contact site of the plate. The burn should be dealt with there and then and a second visit to the theatre avoided.

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Mr. G. N. Lumb:

The production of diathermy burns depends in essential on the very nature of the means used to achieve cutting and coagulation of tissue. The machines used to produce a high-frequency cutting current are of two types: (1) The spark gap diathermy machine, (2) the modern high-powered valve machine.

The purpose of these is the production of ocalized disruption of cells in the path of a current which is fed to the patient between two electrodes. This is produced in the path of the active electrode by means of a very localized high-frequency burn: a burn with minimal coagulation of tissue because, the more charred a tissue becomes, the more electrical resistance is produced and a badly charred surface may act as a complete insulator, so preventing deep cutting taking place. This will become obvious to many of us who in attempting to do resections with a spark-gap machine have found so much charring that further cutting is almost impossible.

The machine in use generally bears a close relationship to the simpler form of radio transmitter. The current is applied to the area between two electrodes: an indifferent or plate electrode which, by Ministry regulations, is earthed, and an active electrode which in essential is small, either point or loop. They are activated by the machine, the patient's tissue forming the completion of the circuit.

The field produced between these two electrodes is essentially one of high frequency heating in all the tissues lying in the path of the current, the maximal concentration lying at the point or loop electrode. Skin burns are produced by three factors: (1) Alteration of the relative areas of contacts with the two electrodes, (2) contacts through other metal objects to the patient, (3) capacitative effects.

In the first group, we have the resistance path to earth produced by a dry or irregular earth plate and the current contact areas may be nearly equal. Fig. 1 shows that a burn is likely to be produced at both ends, wanted and unwanted. It also shows the reduced total current due to the smaller areas of contact. This accounts for poor cutting or coagulating current

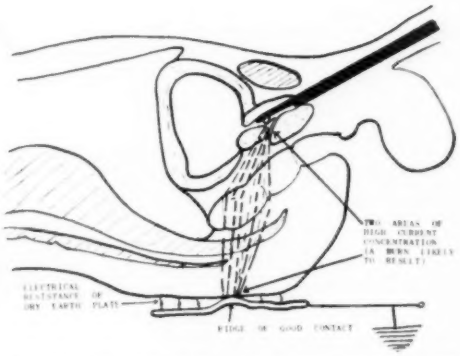

FIG. 1.—Current path with poorly applied and damaged indifferent electrode.

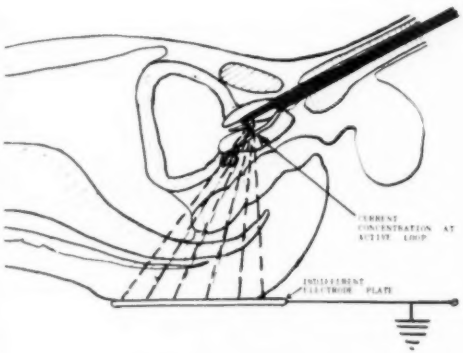

FIG. 2.—Illustrating path of diathermy current during resections.

and illustrates that the natural reaction, to turn up the current dial, would produce quite a severe burn. A further check to find the cause must be carried out. The mains voltage varies in different parts of the country, but this cause of poor diathermy can be corrected by use of the voltmeter and compensator switch on the machine. Equally a partially dry earth plate can give opportunity for a better return path to earth for another metal object touching the patient and a burn results. The object does not need to be metal. If the object is big, there will be a considerable flow of current through both earth plate and object and a burn taking on the object's shape may result. The nearer the indifferent and active electrodes approach one another in size the more the heating effect at both points. Also, heat coagulation of tissue may extend beyond the area of apparent burn

and death of tissue in the surrounding area result at a later date if the burn is not fairly widely excised.

Contacts through metal objects have been adequately illustrated by Mr. Mitchell.

Capacity.—It is not always realized by surgeons that actual contact is not necessary to produce unwanted return paths. Mere separation of the body from an earthed body or metal by a thin area of insulating material may, by virtue of the capacitance existing between them, transfer the high frequency current with heating effect and burn production, just as the radio condenser performs a similar transfer function. Many surgeons have found this to their cost. A light grip on a metal diathermy forceps may result in capacity between a small area of these and the earthed surgeon's hands. The heating effect disrupts the rubber and also the hand, resulting in a few words about perforated gloves, which, however, were really in no way to blame. Because of these possible return paths, it is essential as stated that the diathermy machine should be controlled by the surgeon, the only possible fault in the machine that could cause a burn being a stuck "on-off" pedal relay. This, however, should not pass unnoticed because machines are provided with an indicating neon, which shows when the active electrode is taking current. It might, however, as a further safety measure, be suggested that manufacturers fit an audible device such as a buzzer as well, for modern valve machines are silent.

Ileal Diversion in Spina Bifida—An Alternative Method

By S. Glaser, F.R.C.S.

Bath

In a rural and, to a large extent, geographically circumscribed clinical area the problem of children with clinically significant spina bifida is a small one. Only a few patients have been referred for urological opinion over the last fifteen years. At first the policy was based entirely on conservative principles. For boys abdominal pressure and urine-collecting apparatus has been used. Some girls have kept dry with pressure evacuation of the bladder, but a small hard core has remained who for one reason or another have failed to improve with these techniques, and whose impaired progress at school or in learning to use orthopædic apparatus has necessitated a more radical approach. So far 3 patients have been operated on.

Irvine *et al.* (1956) suggested a method of avoiding uretero-ileal anastomosis. In their experimental dogs they excluded the hazards of this anastomosis by implanting the bladder base with the uretero-vesical orifices undisturbed, and it seemed that this could be equally applied to the cases in hand. A similar technique has been described recently by Cordonnier (1957), who has treated 3 patients by operations similar to those described in this paper. The principle is to anastomose the proximal end of an isolated loop of ileum to the base of the bladder after its fundus has been excised, and to bring the distal end out as an ileostomy. The urethra is severed and closed, thus ensuring that all the urinary drainage is via the ileostomy. One problem was the notorious difficulty of closing the female urethra, also noted by Cordonnier. An attempt was made in the first case to avoid this problem by ignoring the urethra completely, by anastomosing only the trigone with its ureteric orifices to the ileal loop. This was, of course, similar to the technique used in the early attempts at uretero-colic anastomosis. A short account of the first three cases will illustrate the methods and problems more clearly.

Case Histories

Case I.—M. D. G., a moderately intelligent girl of 15, had spina bifida with minor orthopædic deformities of the feet which had been well corrected and which caused her no bother. Her only major disability was urinary incontinence.

On examination.—She had a scar over the sacrum where repair of the spina bifida had been undertaken when she was a baby. No evidence clinically of hydrocephalus; mental development fair. Some sensory loss over both heels and in the sacral area. Equinovarus deformity of the feet. Urological investigation showed continuous incontinence of urine. The excretion pyelogram showed good renal function with no gross back pressure. It was found difficult to measure the residual urine as she could not void, but the bladder usually contained about 120 c.c of urine. Cystoscopy showed bullous trigonitis and large ureteric orifices.

Operation (12.7.57).—The bladder was fully exposed extraperitoneally through a long left paramedian incision. The peritoneum was then opened and a length of ileum isolated, intestinal continuity being restored by end-to-end anastomosis. The bladder was now split open or bivalved by a long anterior incision from the fundus almost into the internal meatus. An oval incision was made to

surround the trigone and ureteric orifices and the incision was deepened through the full thickness of the bladder wall to give a freely mobilized trigone attached posteriorly to the two ureters, the size of bladder segment approximating to the transverse section of the ileum. Unfortunately mobilization of the trigone had separated it from its blood supply and left it entirely dependent on what could reach it along the ureters. The rather blue looking trigone was anastomosed to the proximal end of the isolated ileal loop and the distal end brought out in the right iliac fossa as an ileostomy. The peritoneum was closed carefully around the ileal loop and its mesentery. The bivalved bladder with its intact urethra and the large hole in its base was left *in situ*.

The *post-operative course* was free from any serious general reactions. For the first six days urine drained freely by catheter from the ileostomy. On the seventh day ileostomy drainage ceased and all the urine drained through the stab drainage incision in the left iliac fossa. This lasted five days, when drainage from the ileostomy recommenced, and drainage from the stab wound ceased. But there had now developed an occasional leak from the urethra. A month later on discharge from hospital, she was draining up to 3 l. daily into the bag, but every day there was some leak below. This varied in amount but was never sufficient to necessitate resumption of her waterproof knickers and nappies, nor in fact did she even need to wear a pad. The patient felt that so much had been gained that this small disability could be accepted.

During the next two years she had two incidents of hæmaturia for which no explanation was found. The urethral leak became steadily more troublesome, though not so bad as to need the constant wearing of a pad. The excretion pyelogram showed a normal right kidney but some dilatation of the left kidney and ureter. It was decided to re-admit her for exploration of the left ureter and closure of the fistula.

Operation (7.7.59).—The vesical and prevesical areas were re-explored. Gross fibrosis made dissection difficult and tedious, and the full objectives of the operation were not achieved. The bladder had healed and reconstituted itself around the ileal loop which was attached at the trigonal area and emerged at the fundus. The serosal surface of the ileum seemed to be covered with bladder mucosa. The bladder contained urine and as it was in normal connection with the urethra that accounted for the urinary leak. Urine was entering the bladder through a fistula low in the anterior wall of the ileum. The dense scarring made it dangerous to continue searching for the left ureter. The urethra was found, freed, divided and carefully ligatured distally. The proximal urethra and bladder neck were freely mobilized and subsequently closed as part of the anterior bladder wall closure. The ileovesical fistula was enlarged upwards into the extravesical part of the ileal loop. The ileum and bladder were then anastomosed side-to-side, and the bladder closed anteriorly and distally, especial care being devoted to the bladder neck.

Progress was satisfactory and the patient remained dry below for two and a half weeks, when she began to leak again from the urethra. However, a month after the operation she was quite dry down below and has remained so ever since.

Clearly the idea of using the isolated trigone can only be successful if the blood supply remains adequate. Possibly a larger disc and less mobilization and freeing of the tissues posteriorly would preserve the vascular branches. Certainly it would need much greater mobilization of the ileal loop to bring it so far down into the pelvis.

It was decided to use the simpler method in future cases.

Case II.—**R. P.**, a girl of 7, was referred because her constant urinary incontinence made it impossible to fit her with adequate orthopædic apparatus.

Previous history.—She was operated on immediately after birth by a country general practitioner for closure of a ruptured spina bifida. In his original letter to the neurosurgeon he stated that "there was considerable prolapse of the cord elements and owing to the size of the gap, I could not bring sufficient aponeurosis to cover the deficiency, but the skin was easily mobilized and stitched, healing by first intention". When first seen at hospital the baby was noted to be hydrocephalic, with a spastic paraplegia. The opinion given was that "nature will eventually take its course, and it will be a merciful dispensation if the infant does not survive too long". This, however, was not to be. When first seen seven years later she was a bright child with obvious hydrocephalus and only very slight mental retardation for her age. She still had her meningomyelocele with paraplegia and in addition bilateral congenital dislocation of the hips and bilateral congenital talipes equinovarus. Further neurological opinions were sought and it was agreed that while there was no hope of improvement, there was also no evidence of deterioration. It was thought worth while therefore to make her dry so that she could be taught to walk with apparatus and be fitted for education in a special school.

Preliminary investigations showed good renal function and a moderate bladder residue.

Operation (17.9.57).—The bladder was exposed extraperitoneally and the fundus freed from its peritoneal attachment. An ileal loop was then prepared in the usual manner, continuity of the bowel being restored by end-to-end anastomosis. The urethra was carefully dissected retropubically and divided. The distal end was ligated and oversewn. The proximal end was oversewn with 3 layers of catgut. The previously mobilized fundus and greater part of the bladder were excised leaving a small eggcup of bladder base which was anastomosed to the proximal end of the ileal loop, the distal end being brought out as an ileostomy. Post-operative progress was uncomplicated, and the child remained dry. On the fourteenth day she was seen by the orthopædic surgeon, and arrangements made for her to return to his care. Twelve hours later she

developed a severe urinary leak *per urethram*. This diminished the next day, but continued to a lesser extent for several weeks before finally drying up. Three weeks after her operation she suddenly developed a high temperature, became unconscious, and developed persistent right-sided epilepsy. This status epilepticus lasted approximately a week, but she recovered gradually and ultimately no residual neurological disability remained. For a long period she was nursed sitting up and unfortunately developed flexion contractures of both hips. However, the orthopædic surgeon was able to correct the extra deformities produced; it was not many weeks before he had the child walking in an apparatus, and she has now gone to a special school as originally planned. Post-operative excretion pyelogram showed no change in renal function. Urea and electrolytes were all normal.

Case III.—A. E. C., aged 4. Her management at home was causing considerable distress, and she was therefore submitted to operation earlier than the others. She has sacral agenesis with other spinal abnormalities (fusion of bodies T. 7 and 8, and failure of fusion of spinous processes T. 7–11). She has had a severe left talipes calcaneovalgus which has been treated and she walks fairly well with boots and leather mould. Her main symptom was her urinary incontinence, and it was hoped, if she could be made dry, to send her to school. Preliminary investigations of the urinary tract showed no abnormalities.

15.5.59: The same operation was performed as in Case II. Post-operative recovery was uninterrupted and uneventful. Leaking from the urethra did not occur. At her subsequent review she was keeping well, and her mother was managing the bag satisfactorily.

In conclusion it seemed logical and safer to simplify urinary deviation by excluding the one set of anastomoses known to give rise to many complications. Since there is no pathology necessitating the removal of the bladder base and trigone in these cases, this type of operation seems to be the correct one to use. It is easy to perform, safe for the patient and works satisfactorily.

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Meeting
March 24, 1960

THE following specimens were shown:

Spontaneous Circumrenal Hæmatoma.—Sir ERIC RICHES.

Renal Displacement Due to Retroperitoneal Cyst.—Mr. R. A. MOGG.

Para-renal Tumour in a Child.—Mr. F. J. MILWARD.

Unusual Presentation of Neoplasm of Testis.—Mr. ARNOLD ELEY (for Mr. M. F. NICHOLLS).

(1) **Tumour of Body of the Testis of Müllerian Vestigial Origin.** (2) **Malignant Renal Hypertension.**—Professor L. N. PYRAH.

Phæochromocytoma of the Bladder.—Mr. JAMES O. ROBINSON.

Lymphogranuloma of the Bladder.—Mr. P. E. B. HOLMES (for Mr. YATES BELL).

Carcinoma of Urachus.—Mr. J. P. BLANDY (for Professor V. W. DIX).

Non-specific Granuloma of the Ureter.—Mr. W. R. O'FLYNN (for Mr. ALAN HUNT).

Tumour of the Ureter.—Mr. J. H. CARVER.

Horseshoe Kidney—Antero-positioning—a New Surgical Approach.—Mr. D. W. BRACEY.

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Section of Obstetrics and Gynæcology

President—H. J. MALKIN, F.R.C.O.G.

Meeting
November 27, 1959

DISCUSSION ON MODERN METHODS OF SALPINGOSTOMY

Dr. Raoul Palmer (Paris):

Salpingostomy—A Critical Study of 396 *Personal Cases Operated upon without Polythene Tubing*

Reconstructive surgery of the tubes is difficult and delicate; prognosis depends on careful selection of suitable patients and use of the most favourable technique. Only a careful study of the success or failure in a large series of patients can help in such discrimination. I feel therefore that this series of 396 consecutive salpingostomies, all performed by myself between 1942 and February 1959, may be useful.

Results

In plastic surgery of the tubes, salpingostomy was the operation most frequently performed (57%); its results, however, were poor (15% uterine pregnancies) compared with those of salpingolysis (46%) or tubal implantation (36%).

A. Overall results of 396 *consecutive cases.*—A correct statistical evaluation is difficult.

(1) The only *complete successes* are uterine pregnancies with live babies (52 cases) but a uterine pregnancy followed by abortion shows that the salpingostomy succeeded (60 cases = 15·2%).

(2) *Re-occlusion* or *stenosis* found at two consecutive insufflations is evidence of failure (118 cases = 30%).

(3) *Tubal pregnancies* (23 = 5%) are a success for the salpingostomy but a disaster for the woman, and every effort must be made to avoid their occurrence.

(4) In 130 cases (33%), insufflation still shows normal patency one year after operation, but is not followed by pregnancy. In some patients, however, salpingography has shown some degree of stenosis of the stoma.

In 30 patients we have performed a peritoneoscopy when pregnancy had not occurred within two years of the operation. Post-operative adhesions were rare (less than 10%) even in those patients in whom they had been very extensive at operation. It is apparent that failure is mostly due to intrinsic stenosis of the stoma.

The last difficulty is to know how long to wait before concluding that the operation has been a failure; the average time between operation and conception was 13·5 months but some pregnancies occurred after four or five years; and, as the years pass, the difficulty of keeping in touch with patients increases and we have lost contact with more than 16% of them.

B. Our results have varied with time and three periods can be defined:

(1) 1942 to 1951: 90 operations (Lavalle, 1952) resulted in 15 uterine pregnancies (16·6%) and 2 extra-uterine pregnancies (2·2%). At that time, the incidence of tuberculosis was not significant in comparison with gonorrhœa and post-abortive infection.

(2) 1951 to 1956: 206 operations (Leblanc, 1958) resulted in 24 uterine pregnancies (11·6%) and 15 extra-uterine pregnancies (7·2%); in this period the patients were less carefully selected, and 51 known to have tuberculosis were subjected to reconstructive surgery after thorough medical treatment, with no uterine and one extra-uterine pregnancy. If these 51 patients with tuberculous tubes are omitted, there are still only 15% of uterine pregnancies and 9% of extra-uterine pregnancies which shows that the selection was not as strict as before.

(3) September 1956 to February 1959: 100 patients have been operated on; there are still 19 tuberculous patients without any pregnancy; but among the 81 others there have been 21 uterine pregnancies (25·9%), 6 extra-uterine pregnancies (7·4%) and 40 with normal patency (49%), many only eight to eighteen months since the operation. The most important difference between this series and the others is the systematic use of oral prednisolone during the six post-operative weeks.

Indications for Surgery

More careful selection should lead to better results. The following should be *complete contra-indications:* (*a*) Any other obvious factor of sterility in husband or wife, if not previously cured. (*b*) Women over 37 years of age. (*c*) Recent acute or subacute inflammation.

(*d*) The probability of tuberculosis as the cause of occlusion (65 with no uterine pregnancy and 1 extra-uterine pregnancy).

The *indications* are mostly based on a thorough study of a recent salpingogram, using a hydrosoluble iodine preparation. The favourable cases are those where the isthmus is of normal shape, the ampulla only moderately dilated and the longitudinal plicae of the ampullary mucosa preserved. If the distal portion of the ampulla is very dilated or irregularly shaped, it is probable that a partial resection of the ampulla will be necessary. If the ampulla is threadlike and/or without longitudinal plicae, the prognosis is very poor.

We often perform a peritoneoscopy just before the laparotomy, and do not open the abdomen if the peritoneoscopy shows very dense adhesions, inflammation, or signs suggestive of tuberculosis. Sometimes, we perform a tubal biopsy during the peritoneoscopy.

Other indications may be: (*a*) Some other indication for laparotomy (chronic appendicitis, severe dysmenorrhœa with planned resection of the presacral nerve, dyspareunia due to ovarian prolapse, &c.). (*b*) An operation with apparently poor prognosis may be carried out for psychological reasons, but patients must be warned of the prognosis of salpingostomy, and many then abandon the idea and adopt a child.

By accepting the above contra-indications and rules, the percentage of patients finally submitted to operation during the last three years was only 15% of those with occluded tubes, some 10% having been discarded after peritoneoscopy.

Technique

Before undertaking the salpingostomy itself, it is essential to free adhesions completely and to explore the tubes again.

The first step should be a complete salpingolysis, including resection of all threads and bands round the tubes and ovaries, and perfect hæmostasis.

Selection of the proper technique depends on a fresh examination of the salpingograms and a thorough study of both tubes. This study includes utero-tubal insufflation through a needle inserted in the fundus, the isthmus uteri being closed with the uterine Shirodkar-Magendie clamp, to detect stenosis of the medial part of the tube.

Every salpingostomy should include a tubal biopsy which is a useful guide to post-operative treatment and prognosis.

A study of the type of salpingostomy performed and the associated pregnancy rate shows which techniques should be preferred.

We have made a thorough study of the last 100 patients. The results achieved were 21 uterine pregnancies (21%), 6 extra-uterine pregnancies (6%), 40 normal patencies without pregnancy (40%) 17 re-occlusions (17%), most of them among the 19 patients with tuberculosis, and 16 unknown.

The results differ according to the type of salpingostomy performed and the percentage of success diminishes in direct relation to the length of the tube sacrificed. This length depends mainly on the extent of the disease.

We recognize 4 main types of salpingostomy:

(1) *Codonolysis*, which is gentle separation of agglutinated fimbriae, by dissection or discission and by dilating the ostium with our special fine pelvic forceps in several directions. This operation could be performed on only 10 occasions, with 4 uterine pregnancies (40%) and 1 extra-uterine pregnancy; it is the operation of choice whenever feasible.

(2) *Terminal salpingostomy* includes the opening of the occluded end of the tube with scissors or knife, without resecting any tubal tissue. The incision may be vertical, horizontal, X- or Y-shaped, and eversion of the flaps may be helped by the use of the Bonney clamp; one of the flaps may be used in an attempt to reconstruct the Richard fimbria. This type of salpingostomy, performed in 41 patients, has given 10 uterine pregnancies (24·9%), 3 extra-uterine pregnancies, 18 normal patencies, 8 re-occlusions (there were 6 cases of tuberculosis in this series), 2 unknown.

(3) *Medio-ampullar salpingostomy* cuts off the distal part of the ampulla when it is too much dilated or thickened. The new opening is at the level of the middle of the ovary instead of being below it as normally. We have used either the Bonney cuff method or one of its derivates (Holden and Sovak, 1932; Moore White, 1958; Palmer, *see* below, or the bivalve technique, or the longitudinal incision of Pollosson with his racket-shaped flap (Pollosson and Palmer, 1955). The number in each group is too small to conclude with certainty that any one of these techniques is better than another. We have used the cuff method for the best tubes and the Pollosson longitudinal incision for the worst, when the rigidity of tissues prohibited eversion of the mucosa.

I now prefer a combination of denudation and cuff as follows: (*a*) Freeing of the part to be

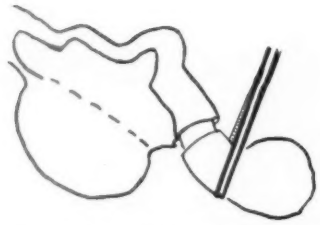

FIG. 1.—Circumcision of serosa and muscularis.

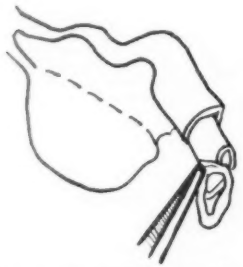

FIG. 2.—Removal of ampulla.

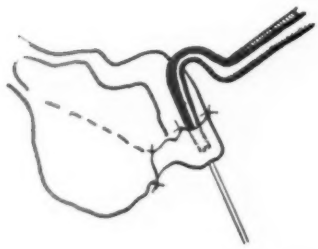

FIG. 3.—Insertion of ureteric catheter into the ampulla.

excised, with section and hæmostasis of the mesosalpinx. (*b*) A Kocher forceps is placed obliquely at the level of section. (*c*) Perpendicular circumcision of serosa and muscularis is performed 15 to 20 mm medially (Fig. 1). (*d*) The ampulla is cut along the forceps. (*e*) Stripping the musculo-serosal cylinder (Fig. 2). (*f*) A ureteric catheter is placed in the ampulla and fixed with a Bonney clamp. (*g*) The cuff of the everted mucosa is fixed to the musculo-serosal margin by 0000 nylon sutures (Fig. 3). (*h*) As a result of the oblique incision, the flap is large enough to reconstruct a Richard fimbria along the mesosalpinx.

In 44 cases of medio-ampullary salpingostomy, we have obtained 7 uterine pregnancies (15%), 2 extra-uterine pregnancies, 20 patencies without pregnancy, 5 re-occlusions and 10 unknown. There were 8 cases of tuberculosis in this series.

(4) *Isthmic salpingostomies*, whatever the technique, have failed (5 cases in this series, 26 in the previous series) with rapid stenosis or occlusion.

In all these cases, sutures were inserted with special atraumatic needles with 0000 nylon.

In a majority of patients, salpingostomy was supplemented by some type of uterine suspension (ligamentopexy of Pellanda, or Mocquot, or vesicofixation of Werth) and often also some type of ovarian suspension (shortening of the utero-ovarian ligament, or fixing the distal pole of the ovary by a catgut stitch to the superior strait to avoid its prolapse to that part of the pelvis where it was previously adherent). Fixation of the tube itself must be avoided.

We have never used polythene tubing for our salpingostomies. For tubal implantation, we are firmly convinced that tubing is not necessary, as we have 75% patency and 36% pregnancy without it, which is equal to or better than results achieved with tubing. But we are not convinced that we are using the best technique for salpingostomy, and leave the question open for discussion.

Post-operative care.—We give antibiotics for four or five days (penicillin 1 million units, streptomycin 1 g, daily) and prednisolone or one of its derivatives. We rarely performed insufflations or hydro-tubations during the first post-operative weeks, for fear of congestion and œdema.

I am convinced that the better results in my last 100 cases are mostly due to the post-operative administration of prednisolone (30 mg a day of Hydrocortancyl for six weeks). The question arises: should prednisolone be given also in the weeks before operation, and also for longer after operation?

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Mr. V. B. Green-Armytage (London):

The New Medical and Surgical Treatment of Tubal Occlusion

Tubal occlusion is still the greatest bugbear of all infertility clinics. The reasons are: (*a*) We live in an age of intravaginal tampons, chemical contraceptives, companionate marriage, unnecessary endometrial biopsies, unnecessary Ds. and Cs., and multiple abortions, criminal or induced. All these are potential causes of ascending infection, mild or severe. (*b*) We live in an age when the slightest suspicion of pelvic infection is treated with massive doses of antibiotics which cure symptoms but leave an invariable legacy of blocked tubes at the fimbriæ. (*c*) We live in an age when the incidence of ectopic gestations admitted into every general hospital throughout the country has risen in recent years by over 50%.

To-day when we have excluded all chance of tuberculosis in the pelvis by history, examination and biopsy, it is very necessary to realise that there is both a new medical and a new surgical technique which, if meticulously carried out, offer far greater hope of ultimate success than we have hitherto been able to achieve. Before detailing this new technique it is very necessary to acclaim the help which I have received from the writings of Bennoun of Paris (1954, 1956) and those of De Moraes and Péano of Rio de Janeiro (1958). Also I wish to thank many patients who, when matters had been fully explained to them, have willingly collaborated, for it is hardly necessary to say that in the beginning much of my work was experimental, not to say speculative, though I am indeed glad that there have been no complications and no disasters.

The medical technique which should be adopted is given in Table I.

TABLE I.—NON-TUBERCULAR TUBAL OCCLUSION

Medical Technique, Hammersmith Hospital

(1) Provided the X-ray picture does not suggest too great obstruction or deformity of the tubes, once a week for three to six weeks an intra-uterine injection through a Lipiodol syringe is given of this solution (P.S.C.)*:

Procaine hydrochloride	100 mg	Freshly prepared and used within twenty-four hours.
Streptomycin sulphate	1 g	
Hydrocortisone ..	25 mg	
Sterile normal saline to	10 ml	

While injecting this fluid. to prevent retrogression the cone of the cannula is kept tightly against the cervix for twenty to thirty minutes. A regular follow-up Rubins test must be done to check results of the technique after say 4–6 injections. If this fails then only is operation considered.

(2) The above intra-uterine injections are essential after removal of the solid polythene rods used in tubo-uterine implantation and after any form of surgical salpingostomy. These injections are easy and painless.

*This injection can be obtained in a 3 vial pack with instructions for mixing prior to use, or in a 10 c.c vial already prepared. In this latter case time and date of making is stated on the label, *and the suspension should be used within twenty-four hours.*

(3) Once operation is decided then for one week before and after operation the patient is given 15 mg a day of prednisolone, and during the third and fourth weeks 10 and 5 mg a day respectively.

Potassium chloride, gr 20 a day, is given routinely by mouth. If preferred 50 mg of cortisone can be given i.m. twice a week as well.

(4) For three days before and after operation i.m. injections of penicillin and streptomycin should be given routinely. We like also to give 5,000 i.u. of Chymar i.m. the day before, of, and after operation.

(5) Bennoun (1954, 1956) and De Moraes and Péano (1958) claim 70% gestations following treatment, and in 88% the tubal obstruction was cleared.

The P.S.C. solution fills the fallopian tubes inside the abdomen. Also in a great number of these the site of occlusion resolves completely and the P.S.C. solution passes without any obstruction. In several of these patients where this has occurred, pregnancy has followed without any surgical intervention to the tubes.

In previous days many of the pathologica conditions would have been looked upon as hopeless from the point of view of repair; whereas in others some form of cuff or spoon type of salpingostomy would have been done with almost certain recurrence of the occlusion. In one of these patients I thought the prognosis was hopeless but after 4 P.S.C. injections, CO_2 passed with ease and she is now three months pregnant. Similarly in another case where the uterus was retroverted after an ectopic, and the only remaining tube was occluded at the fimbrial end and adherent to the pouch of Douglas, after 5 intra-uterine injections it was possible to antevert the uterus and to discover that a Rubins test was readily positive.

In this work I have been cautiously feeling my way by trial and error, both in hospital and in private practice, but the follow-up of these cases has satisfied me that there is great promise in this new technique, provided the details of the charts are faithfully carried out. Admittedly it has limitations and is time consuming, but it is easy and costs little compared with hospitalization. It is my opinion that whereas the procaine makes the technique painless, the streptomycin and the hydrocortisone are antiphlogistic and bacteriostatic, to say nothing of preventing the formation of adhesions. But, if the preliminary radiographs and clinical findings connote that the appendages are distorted and distended it is very unlikely that they will yield to a six- or even twelve-week course of P.S.C. injections.

In such a case surgical skill will be tested to the utmost. Table II indicates the new technique.

TABLE II.—SURGICAL TREATMENT OF NON-TUBERCULAR OCCLUSION

(1) The old treatment: (*a*) Salpingolysis or fimbriolysis. (*b*) Cuff method. (*c*) Spoon incision and application of the ovary into the spoon.
These patients have a success prognosis of under 20%.

(2) *Hammersmith Hospital Treatment:*

(*a*) Chalier linear incision and injection of P.S.C. solution or penicillin and streptomycin along the tubes and into the isthmus from the fundus. (Figs. 1 and 2.)

(*b*) It is essential that all patients have prednisolone and antibiotics before and after operation as mentioned under Medical Treatment, and that the surgeon possesses the essential and specific instruments (*see* Bonney, 1937; Cannon, 1937; Jeffcoate, 1937).

(*c*) Follow-up Rubins test must be done. No such test is positive unless there is shoulder pain and absence of liver dullness.

(*d*) Where possible every patient should have intra-uterine injections of P.S.C. before operation and afterwards once a week for three to six weeks.

(*e*) At operation—dilate or open fimbrial ends. Then perhaps make linear incision up to isthmus. Inject through the fundus (after applying the myomectomy clamp very tightly) the P.S.C. solution freshly prepared, it will be seen to emerge through the tube ends or at the isthmus.

(*f*) Plicate the round ligaments and gently anchor both the ovaries to posterior surface of the uterus before closing the abdomen.

(*g*) If only cornual occlusion exists, then tubo-uterine implantation, with or without using solid polythene rods, should be done.

(*h*) In every case the anæsthetist must be informed before operation that the patient has been and is on adrenocortical hormones.

(*i*) Gestation results 46%. Ectopic 2%.

The instruments required for the modern tubal operations are illustrated in Fig. 3.

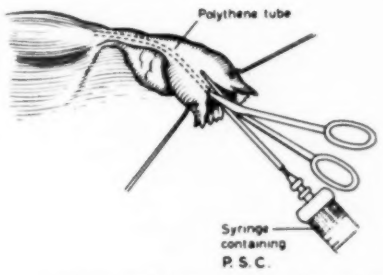


FIG. 1.—Chalier technique showing line of tubal section and flooding with P.S.C.

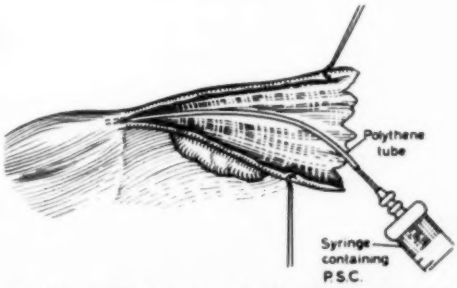
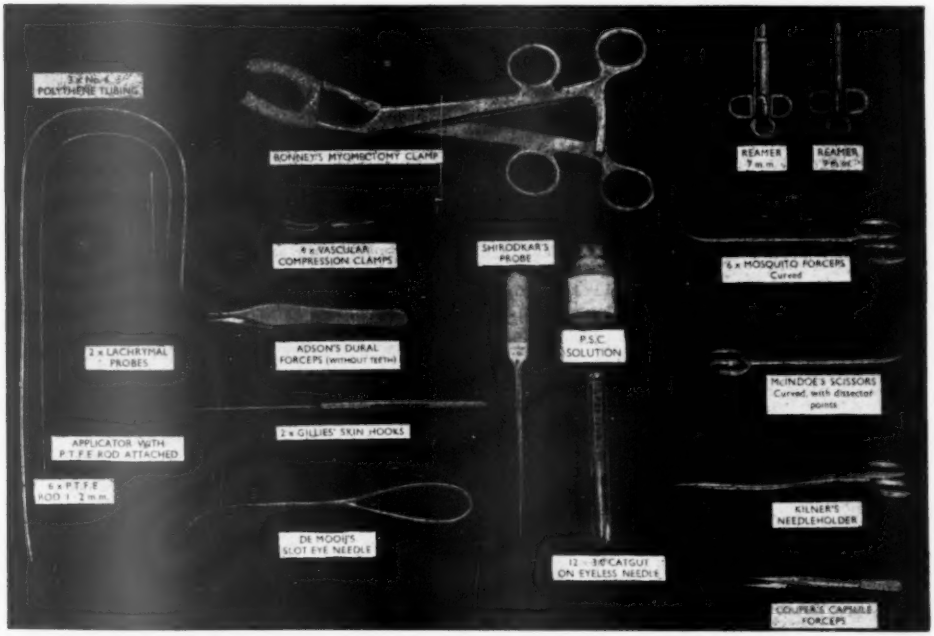


FIG. 2.—Chalier technique showing linear section of tube in fantail fashion.


BONNEY'S MYOMECTOMY CLAMP
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4 x VASCULAR COMPRESSION CLAMPS
SHIRODKAR'S PROBE
6 x MOSQUITO FORCEPS Curved
2 x LACHRYMAL PROBES
ADSON'S DURAL FORCEPS (WITHOUT TEETH)
P.S.C. SOLUTION
McINDOE'S SCISSORS Curved, with dissector points
2 x GILLIES' SKIN HOOKS
APPLICATOR WITH P.T.F.E. ROD ATTACHED
6 x P.T.F.E. ROD 1 - 2 mm.
DE MOOI'S SLOT EYE NEEDLE
KILNER'S NEEDLEHOLDER
COUPER'S CAPSULE FORCEPS

FIG. 3.—Instruments used in tubal surgery.

Fundal technique (Fig. 4).—This consists in applying a myomectomy clamp tightly to the cervix and then while grasping the fundus of the uterus with finger and thumb the needle of a record syringe charged with 10 c.c of P.S.C. or penicillin and streptomycin is plunged into the uterus in the middle line exactly half-way between both tubes. The plunger is depressed and after the first 3 c.c has filled the cavity of the uterus, if the tubes are patent, the solution will be seen to trickle down both tubes to the fimbriæ or, if the Chalier technique has been followed, emerge at the isthmus. If the tubes are not patent the cornua will appear white and distended.

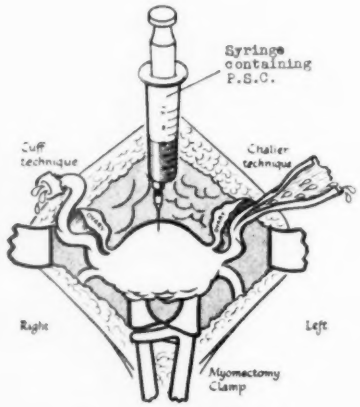

FIG. 4.—Fundal technique.

Tubo-uterine implantation.—Obviously this technique must be included when considering salpingostomy or tubal occlusion. Its ætiology and technique have been previously described (*see* bibliography). The muscle at the site of the tubal implantation is thin, but despite this I do not think there is any real risk of rupture during normal labour, and particularly so if the membranes have ruptured, for Pascal's hydrodynamic law states that the pressure at any point in a liquid depends upon the depth or height of the fluid irrespective of the shape of the container. If pressure is applied to a liquid in a closed system then this is transmitted equally at all points. The pressure at the cervix is thus the resultant of the weight of the liquid above, together with the pressure transmitted from the muscular wall of the uterus. Of course if Cæsarean section is necessary for obstetrical reasons, that is another matter.

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[The paper was illustrated by numerous colour slides.]

Mr. C. W. Kimbell (London):

Salpingostomy can be considered under three headings: (1) Choice of patient. (2) Method of operation. (3) Results.

Choice of patient.—The diagnosis of tubal occlusion is beset with difficulties. Two failed insufflations and two or more failed salpingograms do not necessarily mean occlusion.

A most careful evaluation of the choice of patient for cornual tubal implantation was undertaken by Ostry (1957): 1,830 consecutive case records (1948–55) were examined and apparent cornual occlusion was found in 240. This group was thoroughly reconsidered and often re-examined from both partners' viewpoints. Only 18 patients were finally subjected to operation at which, on abdominal insufflation in 5 patients, tubal patency was established. In 4, both tubes were completely disorganized. This left 9, out of an original 240, in whom bilateral cornual implantation was carried out by five experienced surgeons. Polythene tubing was used and removed in three to twelve weeks.

On repeat salpingography in three to six months, 8 appeared to show occlusion. By May 1956 no pregnancy had occurred.

Method of operation.—The various operative techniques have been fully reviewed by the opening speakers.

Results.—At the Samaritan Hospital salpingostomy was performed on 84 occasions (1949–1958) (Table I). Review of these records reveals how carefully the cases were assessed, repeated insufflations and often as many as 4 salpingograms, with and without anæsthesia,

being carried out prior to operation. Before salpingostomy was undertaken it was usual to warn the patients about the poor results. In fact it was largely because of the insistence of the patient that operation was carried out. It is notable that on opening the abdomen disorganization of the tubes was commonly found, and the chance of the tubes remaining patent seemed poor. Frequently post-operative salpingograms appeared to show tubal occlusion again. Previous undiagnosed tuberculosis of the tubes was found on section in 7, despite negative endometrial biopsies.

TABLE I.—ANALYSIS OF SAMARITAN HOSPITAL OPERATION CASES 1949–58

Site	Operations
Ampullary	57
Ampullary and cornual ..	4
Cornual	22
Mid-tubal repair ..	1
Total	84

Actual follow-up.—Replies or results were known in 51 patients. Only 2 babies resulted, 1 following a cornual implant (spontaneous vaginal delivery) and the other, after a mid-tubal repair (previous sterilization) performed on healthy tubes. In our view the state of the tubes at operation has a most important bearing on results. No baby resulted from operation on the end of tube.

There was 1 ectopic gestation and 1 abortion.

Adoption.—12 patients reported having adopted one or more babies, but no pregnancy had occurred.

REFERENCE

OSIRY, E. I. (1957) *Amer. J. Obstet. Gynec.*, **73**, 409.

Professor J. C. McClure Browne (London), said that he had had the privilege of delivering a good many of Mr. Green-Armytage's patients who had undergone tubal implantation. He had performed Cæsarean sections because he felt strongly that to risk a vaginal delivery in these cases was to tempt fate. A ruptured uterus as the ending to a pregnancy following successful tubal implantation would be a tragedy. When the site of implantation was inspected before emptying the uterus, there was an area 1 in. (2·5 cm) in diameter, with the tube in the centre, and with only peritoneum and amnion covering it; the vernix caseosa was clearly visible within. He was sure that in these cases vaginal delivery was unsafe.

Mr. Walter Calvert (Manchester), said he thought there was a very important reason for not refusing operation to patients over 37 years. Even if the desired pregnancy did not result, the patient could not later regret any omission. While not good for the surgeon's statistics, this did help the patient. It was his practice, in such cases, to insist on a written *request* for the operation from the patient and her husband, stating that they understood that the chances of success were remote. It was surprising how rarely this request was not immediately forthcoming.

He described a patient of his own, treated by bilateral implantation of the tubes in 1955 at the age of 39. The patient had known of her blocked tubes since 1942 and had read about salpingostomy in a popular magazine. The operation was performed in May 1955 and pregnancy ensued in January 1956. Delivery was by Cæsarean section near term, not because of the previous operation, but because of mild toxæmia and a large fœtus—10¼ lb as it proved. The patient had now passed her 40th birthday.

He showed slides of the appearance of the tubes at Cæsarean section, demonstrating thin filmy adhesions, involving the ovaries and the fimbriated ends of the tubes, which seemed to have encouraged the entry of the ovum rather than otherwise.

Miss M. Moore White (London), said that in her practice polythene, a reamer, cortisone and routine antibiotics were not used and the patency rate on the 16 implantation cases was 75%, the conception rate 56% and the live birth-rate 31% if the patient nearly due has a live baby. Histological section confirmed organic occlusion in 14; in 2 the piece removed failed to reach the pathologist.

Dr. M. Rahman (London), said that much had been said about salpingostomy in relation to infertility only. Mr. Green-Armytage had spoken about the incidence of ectopic tubal pregnancy. This had recently increased, according to him, by 50% and was gradually on the increase. Tubal pregnancies had been found to be recurring in the second tube. Gynæcologists were now confronted with a great problem, especially in young women, as to how to conserve the second tube. He asked if Mr. Green-Armytage and Dr. Palmer would give their opinion of salpingostomy for tubal pregnancy.

Professor W. C. W. Nixon (London), asked whether peritoneoscopy was preferable to culdoscopy in the investigation of sterility.

Dr. A. A. Anklesaria (Bombay), said that, in answer to the query regarding the safety of

polythene, she would like to mention a case where the polythene was left inside the uterus inadvertently for about four years. After it was removed, the patient became pregnant within six months.

In cases of infertility, with repeated insufflations and hysterosalpingograms showing cornual blocks, when a laparotomy was done, the following procedure was adopted by Dr. Shirodkar of Bombay. Any adhesions present around the fallopian tubes, ovaries, &c., were separated. The uterus was held with a uterine holding forceps (which closed the cervix also), and the patency of the fallopian tubes was checked by injecting normal saline through the fundus of the uterus. The cornual block, if present, was thus confirmed. In some cases, after separation of the adhesions, saline flowed through the whole length of the fallopian tube or through a part of it and the tuboplasty was modified accordingly.

Dr. Palmer, in reply, said that he had performed approximately 25 conservative operations for tubal pregnancy, of which only five were salpingostomies, because he feared recurrence of tubal pregnancy in those tubes.

The choice between peritoneoscopy and culdoscopy depended first on the contraindications to one or the other method, but peritoneoscopy gave a better view and permitted section of some adhesions and biopsies.

Mr. Green-Armytage, in reply, said he had had personal experience of 5 private patients who had had perfectly normal deliveries after his tubouterine implantation operation, thus confirming Pascal's law, but if in doubt assuredly he would adopt the advice of Professor Browne. The reason why he advocated polythene rods was because they acted like the "sleeper" in a pierced ear. His results had been better since using solid polythene rods and the reamer. Now he was keeping the rods *in situ* for 100 days or more, thus bearing out the clinical experience of Dr. Anklesaria. Dr. Rahman would appreciate that subsequent to the modern ætiological factors mentioned, pelvic infection, mild or severe, was on the increase. This it was that had led to the added incidence of ectopics. Moreover, in the hurry and scurry of any such emergency operation it was by no means rare for the uterus and remaining tube to drop back into a pool of blood in the pouch of Douglas, with the result that the fimbrial end of the only tube, which was perhaps already "not too good" became surrounded by veils of fibrolysed peritoneum, as had been shown in several of the colour slides. To prevent this it was imperative before closing the abdomen to ventro-suspend the uterus by the quickest method using catgut only.

Meeting
January 22, 1960

THE following specimens were shown:

Type I Renal Tubular Osteomalacia: Successful treatment with enormous doses of vitamin D. Delivery by Cæsarean section on account of the contracted pelvis.—Miss PAMELA M. BACON (for Professor W. C. W. NIXON).

The Formation of a Lymphocyst in the Pelvis Following Radical Surgery with Lymphadenectomy for Uterine Carcinoma.—Mr. WILFRID MILLS.

Mixed Mesodermal Tumour of the Cervix in a woman of 51 years which presented as a large polypoid mass protruding from the vagina and which shows no obviously malignant tissue on histology.—Mr. J. BLAIKLEY.

Melanoma of the Vulva.—Mr. A. F. CLIFT.

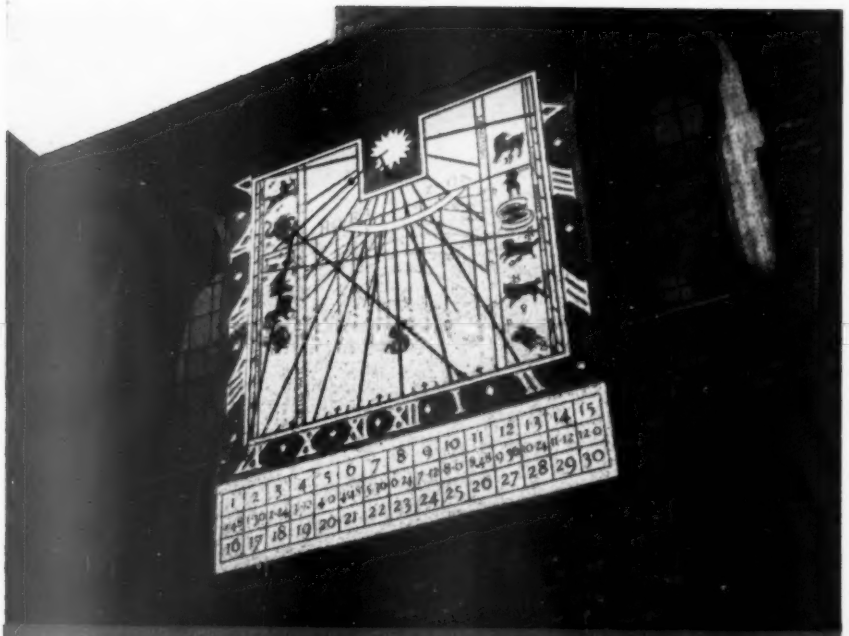
Chronic Inversion of One-half of a Uterus Didelphys.—Mrs. A. E. MARROW.

(1) **Ovarian Fibroma Associated with Carcinoma of the Cervix.** (2) **Meigs' Syndrome with Benign Ovarian Cyst.**—Mr. G. HARRIS.

Malignant Teratoma of Ovary.—Mr. G. DALLEY.

Ovarian Fibroma.—Mr. H. E. REISS.

Parasitic Fibromyoma Removed from a Woman of 90 which had a blood supply through immature blood vessels from the peritoneum lying over the sacral promontory.—Mr. STRUAN ROBERTSON.



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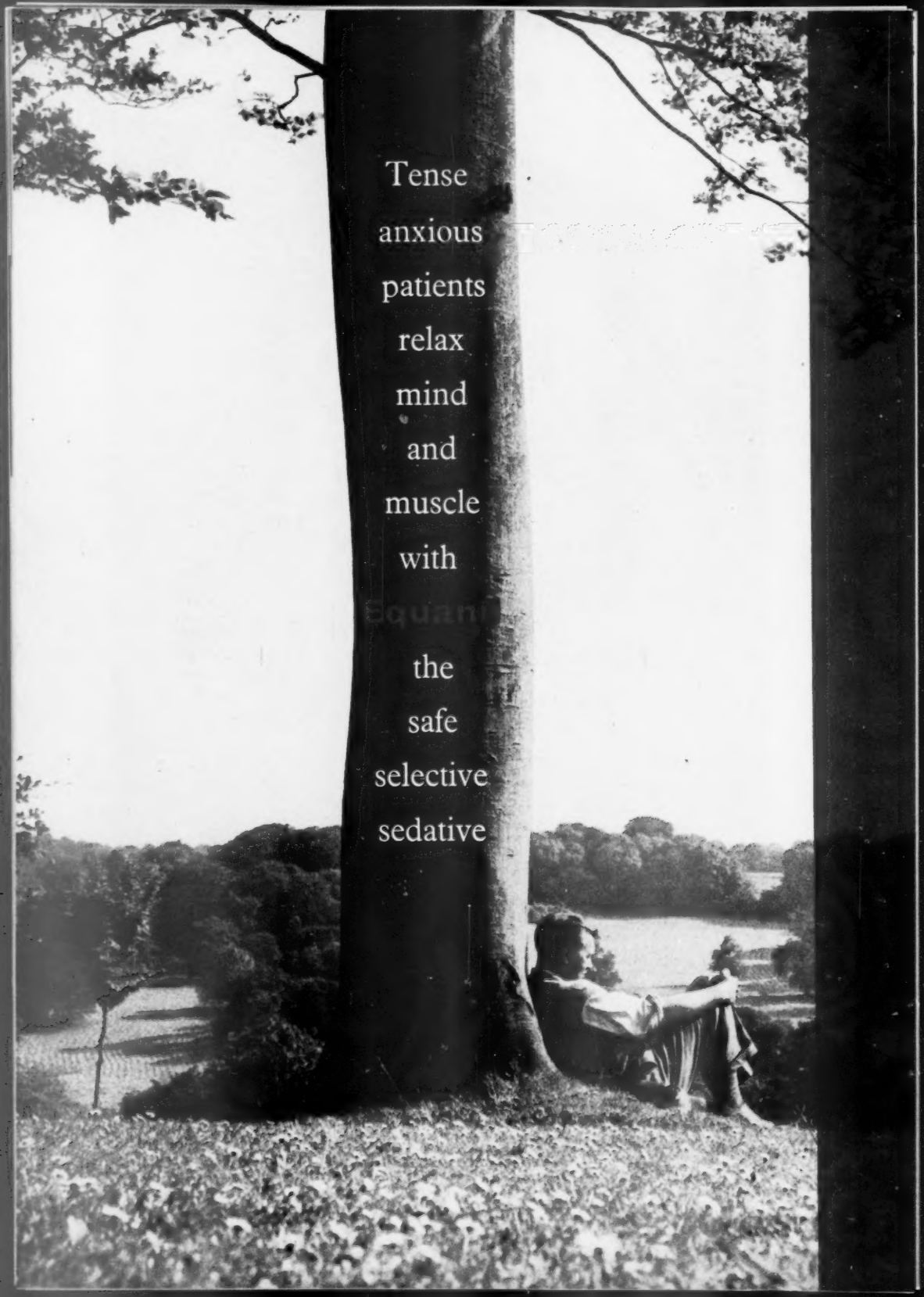
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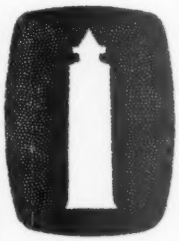

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Section of Anæsthetics

President—J. ALFRED LEE, F.F.A. R.C.S., D.A.

Meeting
January 8, 1960

DISCUSSION ON THE VALUE OF CONTROLLED RESPIRATION IN NEUROSURGERY

Dr. A. R. Hunter (Manchester):

Controlled respiration in neurosurgery was first mentioned by Furness (1957) and its use in this country was pioneered by Mortimer (1957, 1959) and by Galloon (1959). For some years I was not convinced of its value. First, the majority of British anæsthetists until recently employed semi-closed nitrous oxide and oxygen with a trichlorethylene supplement for neurosurgical procedures. It was my clinical impression that this was unsatisfactory in two respects: (1) Woringer and others (1951) believed trichlorethylene, though not nitrous oxide, to be without action on the cerebrospinal fluid pressure, but I had repeatedly seen a steady rise in intraventricular pressure on adding trichlorethylene to a nitrous oxide and oxygen mixture. (2) Though carbon dioxide elimination was probably less effective with a T-piece (Mapleson, 1954; Woolmer, 1954) and the back pressure opposed to gas flows by an ordinary Heidbrink expiratory valve was very small (Mapleson and Mushin, 1954; Hunter, 1960*a*), I, and many neurosurgical anæsthetists with me, felt that the semi-closed technique resulted in a somewhat higher intracranial pressure than methods not using an expiratory valve. (Indeed I had already developed a technique of anæsthesia for intracranial operations in which minimal brain bulk was a prerequisite. In it straining was eliminated by the use of non-volatile supplements to nitrous oxide and oxygen and by topical anæsthesia of the tracheal mucous membrane and an open or T-piece system replaced the semi-closed circuit (Hunter, 1954, 1958*a*).) When controlled respiration was first described for neurosurgery it seemed as if all that it had to offer was an escape from the unsatisfactory volatile supplements to nitrous oxide and perhaps the replacement of the ordinary semi-closed technique of spontaneous breathing by a method which might perhaps be an improvement. It certainly seemed as if controlled respiration should be of value in patients who tended to strain on an endotracheal tube, but it was likely that inflation pressures, already known to be transmitted to the mediastinal œsophagus (Hunter, 1959), would also reach the great veins. These pressures would, it was thought, be reflected in corresponding surges in the intracranial pressure. It was therefore doubtful what the overall advantage would be.

I first used controlled respiration during the removal of a prolapsed intervertebral disc and noted that the unopened theca filled and collapsed with each stroke of the respiratory pump. The technique was next applied tentatively for a patient who developed intractable straining on an endotracheal tube during trigeminal root section. The result was an immediate collapse of the tense brain and the operation, which at one stage seemed as if it might need to be abandoned, was completed without difficulty. This observation was confirmed on ten subsequent occasions. It is, however, interesting that where volatile supplements had been used by members of the junior staff in an endeavour to control straining, and curarization employed only as a last resort, the same immediate response was not obtained. The resulting fall in intracranial pressure was gradual and required thirty to forty-five minutes to reach its maximum. There was therefore some ground for supposing that the removal of the need for volatile supplements to nitrous oxide was one of the reasons why curarization and controlled respiration were so satisfactory.

Since this technique had proved invaluable for dealing with the patient who was straining vigorously under anæsthesia it was then used in cases where only a minor degree of expiratory contraction of the abdominal muscles was occurring. Again it improved operating conditions. Finally 6 patients, in whom there was no overt straining, were curarized and ventilated artificially just before or after the dura had been opened. In each the result was a visible decrease in brain bulk. Two further patients were similarly treated while a manometer was attached to a cannula placed in the lateral ventricle. On each occasion there was a definite and immediate fall in C.S.F. pressure (Fig. 1). This suggested that curarization and controlled respiration might produce a subnormal intracranial pressure. It is not possible to prove this point but it is

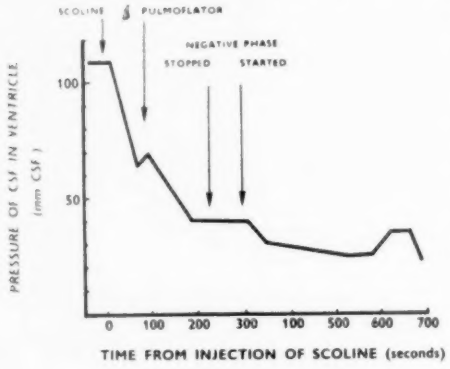

FIG. 1.

perhaps of significance that when patients in coma with cerebral compression and papillœdema have been anæsthetized by this technique the intracranial tension has often been normal at craniotomy. Many believe that there is a close relationship between intracranial and intraocular tension, and curarizing drugs are often used to lower the intraocular pressure in ophthalmic surgery.

An attempt was next made to discover how curarization and controlled respiration exerted its beneficial effects. It seemed most likely that the primary action was on brain bulk: the other possibility, that it decreased the rate of formation, or accelerated the rate of absorption of cerebrospinal fluid, could probably be excluded because of the speed with which the changes occurred.

The brain bulk is under the control of two factors which can operate independently of one another. These are the intracranial venous pressure and the degree of vasodilatation of the cerebral vessels. The latter was studied by Woolf and Lennox (1930) and has attracted attention at intervals since, especially after Kety and Schmidt (1945) showed how it could be directly measured in human subjects as the cerebral blood flow. It is, therefore, not surprising that neurosurgical anæsthetists have tended to think primarily of the effects of their techniques on the cerebral vessels.

The factor which most adversely affects brain bulk during neurosurgical anæsthesia is excess carbon dioxide in the blood. This was shown by Kety and Schmidt (1948) to have a powerful cerebral vasodilator action. Volatile anæsthetic drugs including halothane (Hunter, 1958*b*) also increase brain bulk. They too are known to have vasodilator properties and with diethyl ether this has been proved by direct measurement of the vessels (Finesinger and Cobb, 1935).

Since alterations in cerebral blood flow had in the past provided an adequate explanation of what happens during neurosurgical anæsthesia it seemed likely that the good results of controlled respiration could be similarly explained. As Kety and Schmidt (1946) had shown that hyperventilation reduced the cerebral blood flow, it seemed that this phenomenon should be investigated in neurosurgical cases.

Hyperventilation.—The Blease apparatus which was used for these cases was set working into a dummy lung whose expansion could be measured and it was found that the tidal volume scale was accurate, within a maximum error of 70 ml. Next, the minute volumes of twenty patients were determined by a simple method involving the use of a one-way valve to convert the Magill attachment into an "on demand" source of supply (Hunter, 1960*b*). The tidal volumes obtained were placed alongside those for the appropriate respiratory rate on the Radford nomogram (Radford *et al.*, 1954). Comparable figures were obtained for the period of controlled respiration from the pump rate and the tidal volume scale on the apparatus and these too were compared with the figures from the nomogram (Table I),

TABLE I.—THE TIDAL VOLUMES OF NEUROSURGICAL PATIENTS ON CONTROLLED RESPIRATION

	No. of observations	Actual tidal volume (ml)	Radford tidal volume (ml)
Spontaneous respiration ..	32	266 ± 91	288 ± 71
Controlled respiration ..	20	773 ± 88	387 ± 65

showing that the pump was producing a respiratory exchange roughly double that of spontaneous breathing. This represented a degree of hyperventilation similar to that produced in Kety and Schmidt's (1948) experimental study, but depended to some extent on figures taken from a Radford nomogram which is not entirely acceptable (Nunn, 1960). Further, Campbell *et al.* (1958) and other workers (Howell and Peckett, 1957; Butler and Smith, 1957) have suggested that uneven ventilation may occur during controlled respiration in certain circumstances. It therefore seemed desirable to investigate this matter further by direct measurements of the blood carbon dioxide tension. As arterial puncture is difficult in the cramped quarters available to the anæsthetist during neurosurgical operations, only venous blood taken from the cephalic vein at the wrist or from a vein in the back of the hand could be obtained. Error was reduced as far as possible by selecting patients whose veins could

be readily punctured with minimal stasis and whose hand temperatures had not altered much during the period of investigation. Specimens were withdrawn just before controlled respiration was begun and again after some forty to seventy-five minutes. The pH was determined on a Cambridge meter and the carbon dioxide combining power by the volumetric method of Van Slyke and Cullen (1917). Heparin was used as anticoagulant. The pCO_2 was obtained from the nomogram of Maclean (Davenport, 1958). It is appreciated that this is not an accurate method but as both specimens received identical treatment, changes in pCO_2 ought to be reflected though the absolute values may not be true. The relevant figures in Table II show that no consistent changes occurred comparable with the 30% alteration in pCO_2 in the jugular blood noted by Kety and Schmidt (1946). It would therefore seem that the apparent hyperventilation in these patients was not accompanied by acapnia, especially as it took relatively little carbon dioxide to restart spontaneous breathing at the end of operation. Thus it seemed that though controlled respiration might ensure the normal elimination of carbon dioxide, cerebral vasoconstriction consequent on hyperventilation might not be the main explanation of the low intracranial pressure in these patients.

TABLE II.—THE pCO_2 IN VENOUS BLOOD IN NEUROSURGICAL PATIENTS ON CONTROLLED RESPIRATION

Case No.	Spontaneous respiration pCO_2 mmHg	Controlled respiration pCO_2 mmHg	Tidal volume during controlled respiration: Actual ml	Tidal volume during controlled respiration: From Radford nomogram ml	Duration of controlled respiration min
1	19	24	800	400	60
2	19	19	900	400	45
3	43	40	750	420	75
4	48	48	750	350	40
5	32	24	700	350	60
6	63	40	1,000	470	50

The intracranial venous pressure.—In addition to the rather insecure negative evidence set out in the last paragraph, there is at least one positive indication that the other factor determining brain bulk, namely the intracranial venous pressure, may be altered by controlled respiration. Since Brennan (1938) drew attention to the importance of minor degrees of straining, even in patients who were apparently breathing with a normal tidal volume, anæsthetists have been aware of the existence of this complication and its tendency to raise intracranial pressure. Though direct evidence on this point is lacking it has been accepted, mainly as a result of direct observation of the cerebral vessels at operation, that straining affects the venous return from the skull. It is not difficult to appreciate how curarization could stop straining and thus facilitate the drainage of blood from the brain. Indeed such a mechanism was suggested during the early trial cases by the immediate fall in intracranial pressure. In addition good operating conditions could be lost in patients who tended to "fight the pump" long before there was any major loss of tidal volume. Further, where the relaxant was given to patients with a cannula in the lateral ventricle the fall in intracranial pressure occurred before artificial respiration was begun (Fig. 1). It therefore seems as if the lowered intracranial pressure in this technique is to be related primarily to the administration of the relaxant and thus to the abolition of straining which might raise the intracranial venous pressure.

It is, however, also necessary to explain other clinical observations. The high inflation pressures required to produce a reasonable tidal volume in patients with a poor lung compliance were quite compatible with good operating conditions. Once the brain was exposed there was rarely much movement of it in time with the pump. Starting artificial ventilation did not cause a reversal of the decline in pressure produced by the relaxant (Fig. 1). Increasing the peak inflation pressure was not associated with a major rise in intracranial tension as measured by a cannula in the ventricle nor did varying the negative phase have much effect. Where, however, the airway pressure was not allowed to fall below +5 cm of water in expiration there was an immediate and commensurate rise in the pressure in the ventricle (Fig. 2).

The following is offered as a tentative explanation of these rather unexpected findings. The venous return from the head is carried for the most part by the internal jugular vein down the neck to the thorax. This vessel has no rigid support for its walls apart from the rather incomplete carotid sheath. The pressure of the atmosphere, therefore, has free access to the vein

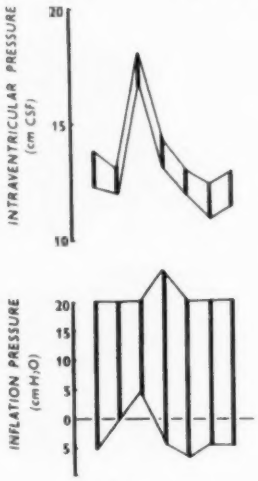

FIG. 2.

and it responds to pressure applied to it from the thorax, not by alterations in the pressure within but by collapsing during inspiration and filling up during expiration. (The atmospheric level of venous pressure in the jugular is visible externally as the venous pulse of Mackenzie (1902) and this moves in and out of the root of the neck with posture and respiration.) The skull on the other hand is a rigid cavity and does not collapse when the pressure inside it is negative. Therefore as long as the mean pressure in the jugular is atmospheric, the pressure in the cerebral veins is determined by the vertical height of the brain above the jugular, not necessarily by the height above the heart. (Anæsthetists regularly make use of this when they sit patients up to reduce the intracranial pressure.)

The mean jugular pressure, however, will be atmospheric only when the outflow from the lower end of the vessel is sufficiently free to allow it to remain collapsed during most of the respiratory and cardiac cycle. The outflow from the jugular is determined by two factors—one static and the other kinetic. The static factor is the mean negative endothoracic pressure which, except during the grossest straining, remains constantly negative. The kinetic factor of the venous return from the lower half of the body is, however, subject to much greater variation. It is normally determined by the mean pressure in the abdomen which is always positive as a result of tonic activity of the parietal muscles, becoming greater with each diaphragmatic inspiratory contraction. During quiet breathing this flow normally balances the jugular return. During straining the intra-abdominal pressure rises and blood is driven more forcibly up the vena cava so that the jugular venous return, which has only atmospheric pressure behind it, is at a disadvantage and the veins of the head and neck become congested. In the patient breathing quietly, the effect of total paralysis of the abdominal muscles and diaphragm is a fall in the intra-abdominal pressure to atmospheric levels. The result is a reduction in the force driving blood up the vena cava and a freer return from the head and neck via the jugular veins. These vessels are therefore collapsed for a longer period of the respiratory cycle and the intracranial venous pressure is correspondingly reduced.

This conception of the jugular veins as a reservoir of blood at near atmospheric pressure, explains why the positively swinging inflation pressure will largely be dissipated in filling up the reservoir, and cannot alter intracranial pressure until the reservoir is fully distended.

Practical considerations.—I have now used controlled respiration for anæsthesia in 134 intracranial operations. My views about its usefulness are reflected in the analysis of 100 recent cases shown in Table III. It is probably the method of choice in supratentorial operations and all but 4 out of 62 were so anæsthetized. Those having posterior fossa operations were, with a single exception, not paralysed and ventilated artificially for two reasons. First, some surgeons prefer to have warning of encroachment on the vital centres given by alterations in breathing. Second, nearly all our posterior fossa operations are performed in the sitting position and the fall in venous pressure in the neck which accompanies the total abolition of abdominal tone in this position adds to the already considerable risk of air embolism. (Though no explanation can be offered, the risk of air embolism in the sitting position for the trigeminal root operation is less under any circumstances. For this operation, curarization and controlled respiration have been safely employed when the patient was difficult to control by other methods.)

TABLE III.—AN ANALYSIS OF 100 CONSECUTIVE NEUROSURGICAL CASES

	Respiration controlled	Respiration spontaneous
Supratentorial	58	4
Posterior fossa	1*	17
Trigeminal root section ..	3	7
	Children 10	

* Patient face down

Children have not been curarized and ventilated

artificially mainly because almost all of them have had posterior fossa tumours. In addition, it has until recently been difficult to obtain suitable cuffed tubes of smaller sizes.

Though it is a vast improvement on other methods of neurosurgical anæsthesia, curarization and controlled respiration brings with it a host of new dangers and problems: thus minor leaks at the jam-fit joints of the apparatus may lead to underventilation, carbon dioxide accumulation and increase in brain bulk. The weight of the heavy double hose of a Blease apparatus or similar respirator will cause kinking of the ordinary red rubber cuffed endotracheal tube. The accompanying respiratory movement of the larnyx will cause some armoured cuffed tubes to damage the mucous membrane if they fit tightly and are *in situ* for a few hours. The slightest attempt on the part of the patient to "fight the pump" will cause an immediate rise in intracranial pressure and, with induced hypotension, disappearance of the radial pulse. It is therefore necessary to have good topical anæsthesia of the trachea and give suitable cough depressants for premedication.

Summary.—Controlled respiration affords better conditions for the operator in neurosurgical procedures where reduction of the brain bulk to a minimum is an overriding consideration. These are brought about primarily by the fact that curarizing drugs abolish abdominal muscular activity so that the balance of the venous return to the heart is upset in favour of that from the cranial side. Like every other anæsthetic technique, curarization and controlled respiration has its limitations and problems and will only give good results when these are appreciated. Meticulous attention to detail is essential.

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Dr. J. McNaught Inglis (Birmingham):

The role of controlled respiration in neurosurgery can be considered under the headings of: (1) The general principles of the method, (2) the suitability of the patient for the method, (3) the requirements of the surgeon, (4) the ability of the anæsthetist.

Increased intracranial pressure at operation may result from the anæsthetic technique, the pathological lesion, or both. Anæsthetic techniques which result in "straining" with consequent increase in venous pressure will produce an elevated intracranial pressure; avoidance of such methods, together with meticulous attention to local analgesia of the trachea in order to abolish "straining", is more generally correct than deliberately induced apnœa and controlled respiration.

Where pathological space-occupying lesions are responsible for increased intracranial pressure the most logical approach is to employ dehydration with Urevert (30% urea in invert sugar) to reduce brain bulk rather than to rely upon emptying the cerebral veins by controlled respiration methods.

Since it is accepted that the bed-rested patient has impaired vasomotor control and since many neurosurgical patients fall into this category, controlled respiration should be avoided as the hypocarbia so produced may result in vasomotor instability.

Although the method may improve operating conditions once the dura is opened, the scalp reflection is often difficult because of increased bleeding, and the use of hypotensive agents is made more hazardous when controlled respiration is used.

The method depends upon striking a balance between increasing the venous pressure during inflation and artificially decreasing it during expiration. Thus a very accurate balance must be maintained. The method is exacting and, in the hands of the inexperienced, produces poor operating conditions.

Generally speaking, the method of reducing intracranial pressure by the use of controlled breathing techniques is best avoided and reliance placed upon meticulous attention to anæsthetic detail—especially posture and tracheal analgesia—together with the use of Urevert by intravenous infusion if pressure is abnormally high or if much brain retraction is intended.

Dr. R. I. W. Ballantine (London) was surprised that Dr. Hunter placed so much emphasis on "straining" during neurosurgical anæsthesia with spontaneous respiration, and asked what method of anæsthesia Dr. Hunter had used prior to his conversion to controlled respiration. Dr. Ballantine asked if this "straining" was clinically apparent, for in his experience using spontaneous respiration with thiopentone, nitrous oxide, oxygen and halothane with 5 ml of lignocaine sprayed into the trachea, straining was rare, and operating conditions good. If the intracranial pressure was high, then urea could be given intravenously.

Dr. Ballantine agreed with Dr. Inglis that much depended on the neurosurgeon with whom one worked. He believed that there were many surgeons, and anæsthetists, who still relied on the pattern of respiration for information about the effect of surgical stimulation and intracranial pressure on the vital centres.

Dr. S. Galloon (Cardiff) said that the results of 130 intracranial operations in which controlled respiration was used had been recently analysed in Cardiff with the help of the Department of Statistics of the Welsh National School of Medicine. These results were matched statistically with those of a similar number of patients operated on while breathing spontaneously. The two groups showed no statistically significant differences in the number of complications during and following operation, or in mortality. Certain trends were, however, evident; for example, there were more cases with tachycardia, cardiac arrhythmias and severe hypotension during the operation in the group which breathed spontaneously.

The mechanism of the undoubtedly improved operating conditions had not yet been fully elucidated. Dr. Hunter had indicated that it was because of its effect on the venous pressure, which in turn influenced the intracranial pressure. Ressel (1958) showed that the intraventricular pressure in dogs was reduced during controlled respiration by the introduction of a negative pressure in expiration. This reduced the peripheral venous pressure. It seemed that some of the benefit must come from the adequate oxygenation and removal of carbon dioxide produced by controlling the respiration. This was borne out by the fact that many anæsthetists used this technique successfully with positive-atmospheric inflation only; such inflation inevitably produced a rise in the peripheral venous pressure (Brecher, 1953).

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Dr. A. J. H. Hewer (London) suggested to Dr. Hunter that by using muscle relaxants he was producing a pooling of blood in the muscles of the dependent limbs and that a similar effect was produced in induced hypotension except that the pooling took place outside the muscles. Whereas his method might be more satisfactory in difficult cases where quiet respiration was hard to achieve, whenever the same effect could be produced with ganglioplegic drugs which did not interfere with spontaneous respiration this method was preferable. With regard to Dr. Hunter's remarks about the relative unimportance of spontaneous respiration, he was certain that even in surgery of the cortex and higher centres of the brain valuable warning of impending cerebral ischæmia was often given by a change in the pattern of respiration.

Dr. B. H. Smith (Birmingham) said that in his experience a method of anæsthesia making use of controlled respiration, using a respirator which gave a negative pressure expiratory phase, produced the best results for most neurosurgical procedures. In particular, the improved operating conditions had enabled the neurosurgeons with whom he worked to perform the majority of their posterior fossa craniotomies with the patients in the prone position instead of, as formerly, in the

sitting posture. This had reduced the danger of air embolism.

The chief requirements of a neurosurgeon from his anæsthetist were minimal bleeding and as low an intracranial tension as possible. To help reduce bleeding, he used phenacylhomatropinium chloride (Trophenium) to produce controlled hypotension when controlled respiration was also being used. This had been deprecated on the grounds that both automatic ganglion blockade and controlled respiration reduced cardiac venous return but, provided the blood lost was replaced, cardiac output remained adequate.

The respiratory pattern which the respirator was set to deliver was critical if optimum operating conditions were to be obtained. The respiratory rate was set to 10–12 per minute, with the inspiratory phase occupying 1 second, and the expiratory phase 4–5 seconds. A negative pressure of −5 cm of water was applied during expiration. In a well-relaxed healthy patient with a reasonably high pulmonary compliance, inflation pressures of 10–16 cm of water were adequate to give a tidal volume of 500–600 ml, and a minute volume of about 6 litres. This might appear rather low, but was sufficient to oxygenate the patient and eliminate carbon dioxide. The mean intrapulmonary pressure was negative, with consequently good cardiac venous return, absence of venous congestion, and low intracranial tension.

He confirmed, however, that the lowering of intracranial tension conferred by controlled respiration was fractional when compared with that produced by Urevert.

Controlled respiration was also of value in explorations of the spinal cord for, whether the prone or lateral position was used, tidal exchange was diminished if a method of anæsthesia making use of spontaneous breathing was employed. The use of controlled respiration in the prone position allowed adequate pulmonary ventilation to be maintained, and good relaxation saved a great deal of retraction of the deep muscles of the back, thus appreciably shortening the operation.

Dr. Ian Jackson asked Dr. Hunter if permanent damage to the medullary centres could occur by reflex arterial spasm brought about by manipulation of cerebral arteries during surgery. Evidence of spasm could be masked by controlled respiration. He instanced a case of a 12-year-old boy who stopped breathing each time manipulation of his aneurysm occurred, pulse and blood pressure remaining unchanged. The operation was completed in a series of short bursts of surgery, allowing time for normal respiration to be re-established between each phase of dissection. He wondered if permanent damage might not have been done had prolonged apnœa been masked by controlled respiration.

Dr. Sheila Anderson (London) felt there was very little place for controlled ventilation in neurosurgery, particularly when surgery in the posterior fossa was carried out in the sitting position. She asked Dr. Inglis if he had experienced a rise in systolic blood pressure after the administration of urea. She had noticed on more than one occasion that when the urea had been run in too fast (40 g in under ten minutes) a marked rise in systolic blood pressure, from 120 to 190 mm Hg, had occurred within two or three minutes of completing the infusion.

Dr. Inglis replied that he had not noticed any specific marked rise following rapid infusion of intravenous urea but that at the beginning of any craniotomy where infiltration of the scalp with adrenaline or nor-adrenaline was practised by the surgeon transient rises of systolic blood pressure were sometimes seen. Since this period coincided with the administration of urea the observed rises might be purely coincidental.

Dr. Olive Jones (Oxford) said that the methods advocated by both speakers had been employed in the Neurosurgical Department at Oxford. The use of intravenous urea had resulted in very marked shrinkage of the brain and good access to the lesion, but there appeared to be more than average bleeding during the reflection of the bone flap. Controlled respiration reduced the bleeding considerably in the opening stages of the operation, but the brain shrinkage was very much less than when urea was used. This might be a recommendation to combine the two methods to improve operating conditions.

Dr. Hunter, in reply, said that straining during anæsthesia was manifest as an expiratory contraction of the flat muscles of the abdomen. In its extreme form there was frank coughing or bucking; a less intense form was often wrongly ascribed to bronchospasm but was in fact merely an expression of compression of the lungs and bronchi by the forceful contraction of the expiratory muscles which displaced the viscera and diaphragm up into the chest. Most

commonly, however, the only sign of straining was a minor contraction of the flat muscles of the abdomen in expiration which would be detected only if a palpating hand was placed on the flank as the patient breathed.

Such straining was probably the response to the presence of an endotracheal tube and was, as Dr. Ballantine suggested, preventable by a topical tracheal anæsthesia with lignocaine. Unfortunately, however, many intracranial operations lasted longer than the period of action of this drug, even when adrenaline was added to it, with the result that straining of a mild degree developed after some two hours. Halothane abolished this form of straining more effectively than any other supplement to nitrous oxide and oxygen though at the cost of some increase in the cerebral blood flow and therefore an increase in the brain bulk. Dr. Hunter had in fact used halothane in this way previously. Controlled respiration, however, abolished the straining without any increase in intracranial pressure and was therefore more satisfactory.

It was true that the employment of controlled respiration for intracranial surgery involved the loss of the signs afforded by the changes in respiration produced by surgical stimulation. These were of value mainly during procedures in the posterior fossa particularly when it was doubtful how far a tumour extended into the brain-stem. In consequence he did not use controlled respiration in such cases. In the supratentorial compartment of the skull, however, even in the third ventricle area, the appearance of respiratory upset as the result of surgical stimulation tended to indicate that irreparable damage had already been done. Loss of the respiratory signs was thus not of the same importance, as the patient's safety depended rather on an appreciation by the surgeon of the limits beyond which he might not trespass. These had now been fairly clearly defined and he had not for many years now seen a case of hypotension, tachycardia, and hyperthermia of hypothalamic origin, like those reported in 1952 (*Proc. R. Soc. Med.*, **45**, 427).

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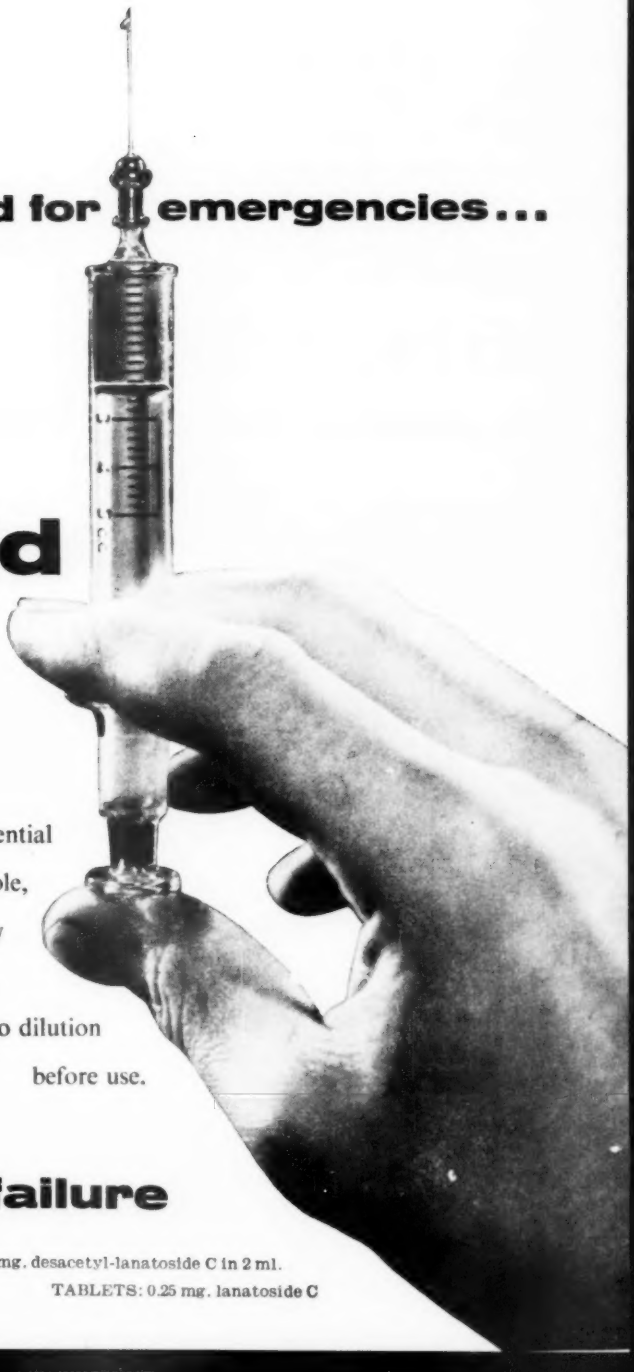

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Proceedings of the Royal Society of Medicine

Vol. 53
373

Clinical Section

President—T. C. HUNT, D.M.

Meeting
February 11, 1960

MEETING HELD AT ST. MARY'S HOSPITAL, LONDON

I. INTESTINAL DISEASE

Three Cases of Crohn's Disease with Ulcerative Colitis

Case I.—Sir ARTHUR PORRITT, K.C.M.G., F.R.C.S., and T. C. HUNT, D.M.

R. M., male, aged 33.

Diarrhœa and abdominal pain began in 1951, and a side-to-side anastomosis was made between the transverse and the pelvic colon to by-pass a grossly thickened segment of descending colon. Symptoms returned transiently in 1952, but he was then well till 1959 when he began passing 6 watery stools a day and lost weight. A perianal abscess developed later in the year.

Barium enema showed granulomatous changes at the site of the anastomosis and in the by-passed segment. Biopsy of perianal granulation tissue showed chronic inflammatory cell infiltration with giant cells. At operation the colon near the anastomosis was thickened and inflamed; a subtotal colectomy was performed and the cæcum anastomosed end-to-end to the lower sigmoid colon. There was irregular ulceration of the resected colon with polyposis. The histological appearances were those of chronic ulcerative colitis.

After a good recovery from the operation a fæcal fistula developed in the lower end of the abdominal wound.

Case II.—T. C. HUNT, D.M., and Sir ARTHUR PORRITT, K.C.M.G., F.R.C.S.

R. L., male, aged 28.

Recurrent diarrhœa and abdominal pain in 1957 was associated with a loss in weight of 3 st. Laparotomy performed for intestinal obstruction later in 1957 showed contraction and thickening of the wall of a segment of terminal ileum which was resected. The specimen showed submucosal fibrosis with round cell infiltration and hyperplasia of the lymph follicles. No giant cells were seen.

In 1958 he had iritis and the diarrhœa returned. There was fever and abdominal distension but these resolved with antibiotics and intravenous fluids. A barium enema showed extensive polypoid changes throughout the colon. Since this episode he has remained well with only occasional diarrhœa.

Case III.—T. C. HUNT, D.M., and C. NAUNTON MORGAN, F.R.C.S.

M. S., male, aged 20.

Diarrhœa began in 1954 and became severe. In 1957 he was admitted to the Royal Masonic Hospital. A barium enema showed typical changes of ulcerative colitis in the left colon but segmental changes resembling Crohn's disease in the right colon and ileum. There was some improvement with dietary treatment and steroids but later in the year subtotal colectomy was performed. There was a mass in the region of the cæcum and the mucosa of the terminal ileum, cæcum and adjacent ascending colon was smooth and atrophic. Beyond this the colon was œdematous and ulcerated.

Microscopically the submucosa was œdematous and infiltrated with round cells, but more deeply there was lymphoid hyperplasia and multinucleated giant cell formations.

Dr. T. C. Hunt: These patients demonstrate coexistence of Crohn's disease and ulcerative colitis. In one the initial lesion was in the colon, but segmental narrowing of the terminal ileum was a feature of the other cases. Later changes in the colon were typical of ulcerative colitis, two patients having polyposis. The histological picture showed a transition from superficial chronic ulceration to deeper lymphoid hyperplasia and giant cell systems. The local changes in the lower ileum of typical Crohn's disease are probably manifestations of a generalized disturbance of the gut which may involve the colon producing segmental lesions or diffuse ulcerative colitis.

Ulcerative Colitis with Carcinoma of the Colon.—T. A. KEMP, M.D., and J. L. STEPHEN, F.R.C.S.Ed.

An operation specimen showing a carcinoma in the ascending colon with diffuse ulcerative colitis.

Idiopathic Steatorrhœa.—T. C. HUNT, D.M.

Typical idiopathic steatorrhœa, confirmed by jejunal biopsy, responding to a gluten-free diet.

Diarrhœa and Peripheral Neuritis.—T. C. HUNT, D.M.

Mild peripheral neuritis associated with diarrhœa and some impairment of vitamin B_{12} absorption.

Whipple's Disease.—J. W. LITCHFIELD, F.R.C.P.

Diagnosis established by histological examination of jejunal biopsy specimens and mesenteric nodes removed at laparotomy.

II. ARTERIAL SURGERY

Atheromatous Stenosis of the Carotid Artery.—Professor C. G. ROB, F.R.C.S., and J. R. KENYON, F.R.C.S.

A. T., female, aged 74.

Attacks of anæsthesia and loss of power in the right side. The power of speech was also lost during the attacks and there was difficulty in swallowing, although she could hear distinctly. The left eye became completely blind. The attacks lasted for ten to fifteen minutes and were followed by complete recovery. She had 33 such episodes from December 1953 up to her admission to hospital on April 9, 1954.

A left carotid angiogram showed atheromatous obstruction of the internal carotid artery (Fig. 1). During the course of her investigation in hospital the patient had 7 attacks similar to those described above. On 19.5.54 the atheromatous stenosis was resected (Fig. 2) with end-to-end anastomosis of the common to the internal carotid arteries under hypothermia. No further attacks have occurred in the five years nine months since excision of the atheromatous stenosis.

FIG. 1.

FIG. 2.

Three Cases of Acute Dissecting Aneurysm of Aorta.—Professor C. G. ROB, F.R.C.S., and J. R. KENYON, F.R.C.S.

Case I.—H. S., male, aged 48.

Sudden onset of very severe pain in chest and abdomen three hours prior to admission to hospital on 16.7.58. The pain later radiated to the left leg, which became cold, white and numb. He had been short of breath on exertion for the past three months. All pulses were absent in the left leg which was also pale and cold with reduced capillary return.

An aortogram showed a dissecting aneurysm extending from the aortic arch to the iliac arteries. The left iliac artery was occluded. At operation (17.7.58) a re-entry ostium was formed in the abdominal aorta above the bifurcation and the distal lumen obliterated. This was

followed by the return of pulsation in the left leg. The patient had an uneventful recovery and returned to work in three months. He remains well one year seven months later.

Case II.—L. W., male, aged 55.

While hammering a stake into the ground the patient experienced sudden intense substernal pain, radiating within a few minutes to the back and upper abdomen. He was shocked, but recovered after admission to hospital. Two weeks later he had a second attack of pain and blood pressure was then recorded as 50/30. After a week he was transferred to St. Mary's Hospital.

On admission.—Shocked, pale and sweating with cold extremities. Blood pressure 210/100 in both arms and legs. A systolic murmur was heard over the xiphisternum. The peripheral vessels were all patent. An aortogram showed a dissecting aneurysm extending from the upper thoracic aorta to the level of the diaphragm.

An emergency operation was performed. The dissection was exposed through a left thoraco-abdominal incision. The chest contained recently shed blood and clots. After cross-clamping the aorta, a re-entry foramen was formed 6 sq. cm in area, and the distal dissection obliterated. Two pints of blood were transfused. The patient had a relatively uneventful recovery. Blood pressure was maintained in the region of 140/80 with Serpasil, Inversine and hydrochlorothiazide.

Case III.—F. D., male, aged 43.

The patient experienced an aching pain in the right leg from knee to buttock followed ninety minutes later by severe pain in the right groin extending to the knee with numbness and paræsthesiæ in the foot. A swelling later appeared in the groin. The peripheral pulses were absent in the right leg, but normal in the left. Blood pressure 130/80.

An aortogram showed some aneurysmal dilatation of the right common iliac artery with a linear translucency suggesting a dissecting aneurysm. The right external iliac artery appeared to be occluded near its origin, the lower limit of the block lying at about the origin of the common femoral artery. The femoral artery below the block filled well.

At operation (18.6.59) the false sac of the aneurysm was decompressed and the distal circulation reconstructed by a terylene prosthesis from the left common iliac artery to the right common femoral artery. The pulses were restored in the right leg. The patient has recovered well and is able to do a full day's work.

(1) Aortic Thrombosis: Claudication Relieved by Aortic Reconstruction with Homograft. (2) Aorto-ileo-femoral Atheroma with Multiple Arterial Occlusions.—PROFESSOR C. G. ROB, F.R.C.S.

III. RENAL ARTERIAL STENOSIS

Three Cases of Renal Artery Stenosis.—J. I. S. ROBERTSON, M.R.C.P. (for Professor W. S. PEART, F.R.C.P.)

Case I.—W. F., male, aged 46.

Admitted 29.9.58 with six weeks' history of blurring of vision of the left eye, and increasing shortness of breath on exertion.

On examination.—Blood pressure 260/160. Fundi: bilateral papillœdema with very numerous exudates and hæmorrhages. Loud bruit just above and to the left of the umbilicus.

Investigations.—Selective renal arteriography (Dr. D. Sutton) demonstrated atheromatous stenosis of the main left renal artery (Fig. 1). The lower pole of the left kidney was shown to be supplied by a separate smaller artery arising directly from the aorta.

Ureteric catheterization studies demonstrated a diminished urine flow from the left kidney, with lowered concentration of sodium and

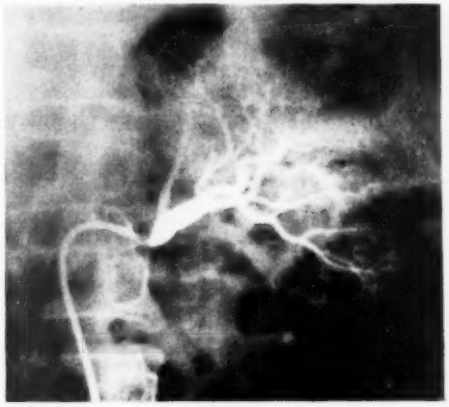

FIG. 1 (*Case I*).—Selective renal arteriogram.

A

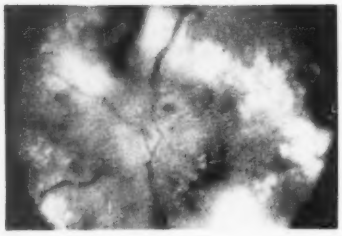

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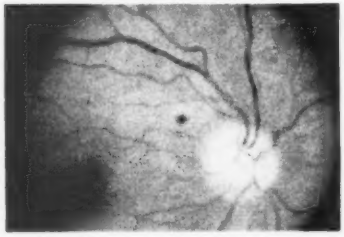
FIG. 2 (*Case I*).—Fundus photographs, before nephrectomy.



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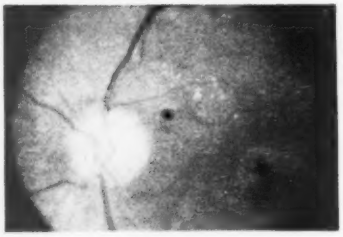

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FIG. 3 (*Case I*).—Fundus photographs, five months after nephrectomy.

chloride in the urine from the affected side. The clearances of creatinine and para-aminohippurate (P.A.H.) were diminished on the left as compared with the right. These changes were not so marked as in Case III, presumably because the lower pole of the left kidney was being perfused with blood at the same pressure as the right kidney.

Operation 29.10.58 (Mr. Kenneth Owen).—There was a considerable pressure drop across the stenosis. Thrombo-endarterectomy was performed and the pressure gradient corrected.

Post-operatively there was no change in the blood pressure; aortogram (29.11.58) showed that the main left renal artery was now occluded.

Attempts were made to control the blood pressure by means of drugs, but with little effect. Gross bilateral retinopathy remained (Fig. 2A and B).

22.5.59: Left nephrectomy.

Subsequently there has been a marked fall in the blood pressure without the aid of drugs, and clearing of the retinal abnormalities (Fig. 3A and B).

Case II.—P. S., male, aged 47.

Admitted 4.12.59 with five months' history of early morning headaches, deterioration of vision and epistaxis.

In the three months before admission he had had to pass urine rather more frequently during the daytime. A normal quantity of urine was apparently passed on each occasion. Since 1957 he has had to get up three or four times each night to pass urine.

On examination.—Blood pressure 220/135. Scattered hæmorrhages and exudates both retinæ. Systolic murmur over left upper abdomen.

Investigations.—Ureteric catheterization studies showed diminished urine flow from the left kidney as compared with the right, with lowered concentration of sodium and chloride on the left side. Inulin and P.A.H. clearances were diminished on the left, but the inulin and P.A.H. concentrations were considerably raised in the urine from the left kidney as compared with the right. These findings suggested a left renal artery stenosis, which was confirmed by selective renal arteriography (Dr. D. Sutton) (Fig. 4).

Intravenous pyelography performed in the customary manner, with fluid restriction for twelve hours previously (21.12.59), suggested diminished urine flow on the left side, though both renal tracts were well demonstrated on the later films. In view of the high concentration of P.A.H. and of inulin in the urine from the left side as seen in

FIG. 4 (*Case II*).—Selective renal arteriogram.

the uretric catheterization studies, it was thought that intravenous pyelography with a water load of 500 ml might show up the left side, but obscure the right. A second I.V.P. (22.12.59) performed in this manner confirmed this prediction (Fig. 5).

Operation 23.12.59 (Mr. Kenneth Owen).—A marked pressure drop was demonstrated across the stenosis. Thrombo-endarterectomy was performed, and the splenic artery was anastomosed to the left renal artery distal to the stenosis. At the end of the operation the pressure in the left renal artery had returned to the same level as the aortic pressure.

Post-operatively there has been a fall in blood pressure to normal levels, with resolution of the retinal changes.

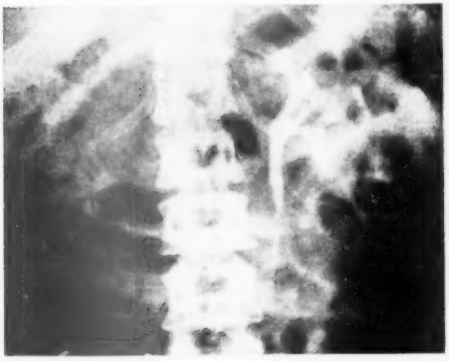

FIG. 5 (*Case II*).—Intravenous pyelogram with water loading.

Case III.—A. T., male, aged 48.

Admitted 2.12.58 with a history of increasing dyspnœa on exertion in the previous four months. Two weeks before admission the vision of the left eye had become severely impaired.

On examination.—Blood pressure 240/150. Systolic murmurs over both femoral arteries and over central abdomen. Fundi: blurring of optic disc margins on each side; numerous exudates and hæmorrhages.

Investigations.—Intravenous pyelogram showed no abnormality apart from better contrast in the right kidney (Fig. 6).

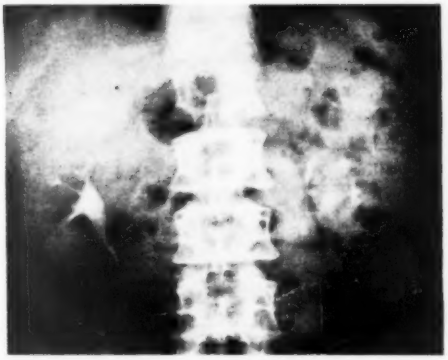

FIG. 6 (*Case III*).—Intravenous pyelogram.

FIG. 7 (*Case III*).—Selective renal arteriogram (Reproduced from *Proceedings*, 1960, **53**, 33, by kind permission of Mr. Kenneth Owen.)

Selective renal arteriography (Dr. D. Sutton) showed an atheromatous stenosis at the origin of the right renal artery, with post-stenotic dilatation (Fig. 7).

Ureteric catheterization studies demonstrated a diminished urine flow from the right kidney, with lowered concentration of sodium and chloride in the urine from the right side. The creatinine and P.A.H. clearances were markedly diminished on the right as compared with the left, though the concentrations of creatinine and of P.A.H. on the right side were higher than on the left.

Operation 7.1.59 (Mr. Kenneth Owen).—The pressure in the right renal artery distal to the stenosis was shown to be markedly reduced. Thrombo-endarterectomy was performed, with restoration of the pressure in the renal artery.

Subsequently the blood pressure has returned to normal levels without the administration of drugs. The appearances of the retinæ have returned to normal, and the vision is now unimpaired.

IV. CHORIOCARCINOMA

Four Cases of Choriocarcinoma

Case I.—K. D. Bagshawe, M.R.C.P. (for W. D. W. Brooks, C.B.E., F.R.C.P.).

G. B., female, aged 32, had had three normal pregnancies, the last of which was in 1953.

In July 1956 she developed irregular and heavy menstrual loss, and diagnostic curettage in January 1957 showed only endometrial hyperplasia. Following this curettage she had a pulmonary embolus, from which she made a normal recovery, but menorrhagia persisted and in April 1958 hysterectomy was carried out. Examination of the uterus showed no abnormality either macroscopically or microscopically. Ten days post-operatively she had a further episode of chest pain and dyspnœa with radiological changes suggestive of pulmonary embolism. Six weeks later she had a further episode of pleuritic pain on the left side of the chest with sudden onset and accompanied by slight hæmoptysis and dyspnœa. She was started on anticoagulant therapy but became increasingly dyspnœic and had signs of severe pulmonary hypertension. Continuous oxygen therapy in tent, but arterial oxygen saturation fell to 75% and she developed a respiratory alkalosis.

On 14.8.58 a Friedman test was positive. Gonadotrophin excretion in the urine at the time was estimated at $>$200,000 m.u. in twenty-four hours.

Three days later she started intermittent high dosage anti-folic acid and mercaptopurine therapy and this was continued until March 1959. Following each course of treatment marked leukopenia, stomatitis and proctitis developed and there was progressive alopecia and pigmentation throughout this period. Following the first course of treatment there was a rapid improvement in her dyspnœa, and after two months she became asymptomatic apart from the side-effects of the drugs. Since November 1958 gonadotrophin excretion has been within normal limits and has remained within normal limits during the past year since treatment was discontinued. The pulmonary hypertension has completely regressed and she continues in good health.

Case II.—K. D. Bagshawe, M.R.C.P. (for W. D. W. Brooks, C.B.E., F.R.C.P.).

I. F., female, aged 24, presented with menorrhagia following a normal full-term pregnancy. Diagnostic curettage in January 1957 showed no abnormality but she subsequently developed bilateral frontal headaches and was found to have retinal detachments with intra-orbital metastases. Her vision was severely impaired, she lost weight and metastases appeared on chest X-ray. The Hogben test was negative and the gonadotrophin assay, though raised, never reached the levels usually associated with chorionic tumours. Hysterectomy was performed and revealed a rounded 7-cm chorionepithelioma in the wall of the uterus. Following hysterectomy her condition deteriorated and the gonadotrophin titre increased. Treatment with anti-metabolite drugs, as in Case I, was given from June to December 1959. The pulmonary metastases regressed after six weeks of treatment and her vision improved. Gonadotrophin excretion has been within normal limits for the past three months.

Case III.—K. D. Bagshawe, M.R.C.P. (for A. M. Fleming, M.D., F.R.C.O.G.).

L. D., female, aged 24, presented with menorrhagia following a normal full-term pregnancy. The diagnosis of chorionepithelioma was made on examination of curettings, and at hysterectomy a 5-cm diameter tumour was found in the uterine wall. Following hysterectomy pulmonary metastases appeared and the gonadotrophin titre rose to 2,000,000 m.u. in twenty-four

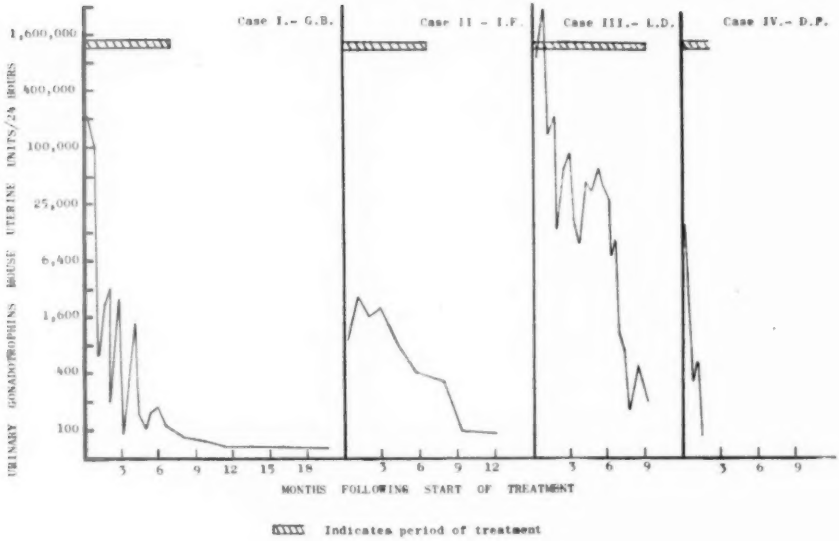

FIG. 1.—Response to treatment in the 4 cases of choriocarcinoma.

hours. Therapy on the lines described in Case I was started in July and still continues. Regression of pulmonary metastases was noted after six weeks and the gonadotrophin titre is now within normal limits (March 1960).

Case IV.—K. D. BAGSHAWE, M.R.C.P. (for C. H. EDWARDS, M.R.C.P.).

D. P., female, aged 31, a coloured woman, had had a molar pregnancy in 1954 and hysterectomy was performed in Jamaica. Microscopical examination of the tumour showed areas of active infiltration suggestive of choriocarcinoma. Following operation she developed features of a lesion of the cauda equina and she received radiotherapy to the back. Late in 1958 she began to notice weight loss and lethargy. A chest X-ray in November 1959 revealed a large, well-defined shadow in the left lung field. Therapy with anti-metabolite drugs has begun.

V. MISCELLANEOUS

Mumps Myxœdema.—J. J. BROWN, M.R.C.P. (for Professor W. S. PEART, F.R.C.P.).

Mrs. J. L., aged 35.

In July 1958 two of the patient's children developed fever and bilateral parotid swellings, diagnosed as mumps. In August 1958 the patient also developed swelling in both parotid regions. In addition, she complained of a tender lump in the mid-line of the neck anteriorly (in the region of the thyroid gland), which was painful while swallowing. The lump subsided within two to three weeks, but during the autumn 1958, she noticed increasing tiredness, intolerance to cold, slowness of thought and movement, hoarse voice, dry skin, puffiness of her face and increase in weight.

On examination (January 1959) the salient features were a puffy face, dry skin and an impalpable thyroid gland. Myxœdema was diagnosed.

Investigations.—^{131}I-neck uptake 10% at twenty-four hours. No response to T.S.H. Thyroid auto-antibodies (Dr. D. Doniach): Tanned cell agglutination positive 1/2,500; thyroid complement-fixation and precipitin test negative.

Mumps complement-fixation test was positive in a titre of 1/32, i.e. diagnostic of mumps within the previous twelve months (Dr. C. E. D. Taylor).

Thyroid biopsy: Disorganization of normal pattern with increase of fibrous tissue and

infiltration with plasma cells and lymphocytes. Culture of this biopsy failed to grow mumps virus.

Treatment.—Tri-iodo-thyronine followed by maintenance with tabs. thyroid with complete disappearance of all symptoms.

It is postulated that the mumps virus invaded the thyroid gland producing subacute thyroiditis and that myxœdema followed progressive destruction of the gland as a result of auto-antibody mechanisms.

Eylan *et al.* (1957) cultured the mumps virus from thyroid gland biopsies taken during the febrile stage of subacute thyroiditis, but none of their cases progressed to myxœdema.

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Collagen Disease with Involvement of the Central Nervous System.—N. A. J. HAMER, M.R.C.P. (for T. C. HUNT, D.M.).

O. R., male, aged 62.

Recurrent febrile illness for four years with iritis, fever and a polymorph leucocytosis controlled by steroid therapy. At the onset there was a confusion, left hemiparesis and papillitis. The EEG showed a right temporal focus. During each relapse the E.S.R. rose to over 100 mm in the first hour (Westergren) and there was gross disturbance of the plasma proteins with reduction of the albumin and an increase in the alpha-2 and gamma globulin fractions.

Chest X-ray showed prominent pulmonary striation and hilar shadows. The Mantoux test was positive 1 in 1,000, and the Kveim test negative. A conjunctival biopsy showed non-specific inflammation. There was moderate proteinuria throughout the illness, and many cells and casts were found in the urine during relapses. A renal biopsy showed mild fibrosis only.

This patient has evidence of a diffuse inflammatory process with involvement of the uveal tract, lungs, kidney and central nervous system. Sarcoidosis has been suggested as a possible diagnosis but there is no evidence of the nephrocalcinosis which is usually associated with the renal changes in this condition.

Two Cases of Brill-Symmers Disease

Case I.—T. C. HUNT, D.M., and B. LEONARD, M.D.

Aplastic anæmia with typical changes in the resected spleen.

Case II.—J. CARADOC EVANS, M.R.C.P., and T. C. HUNT, D.M.

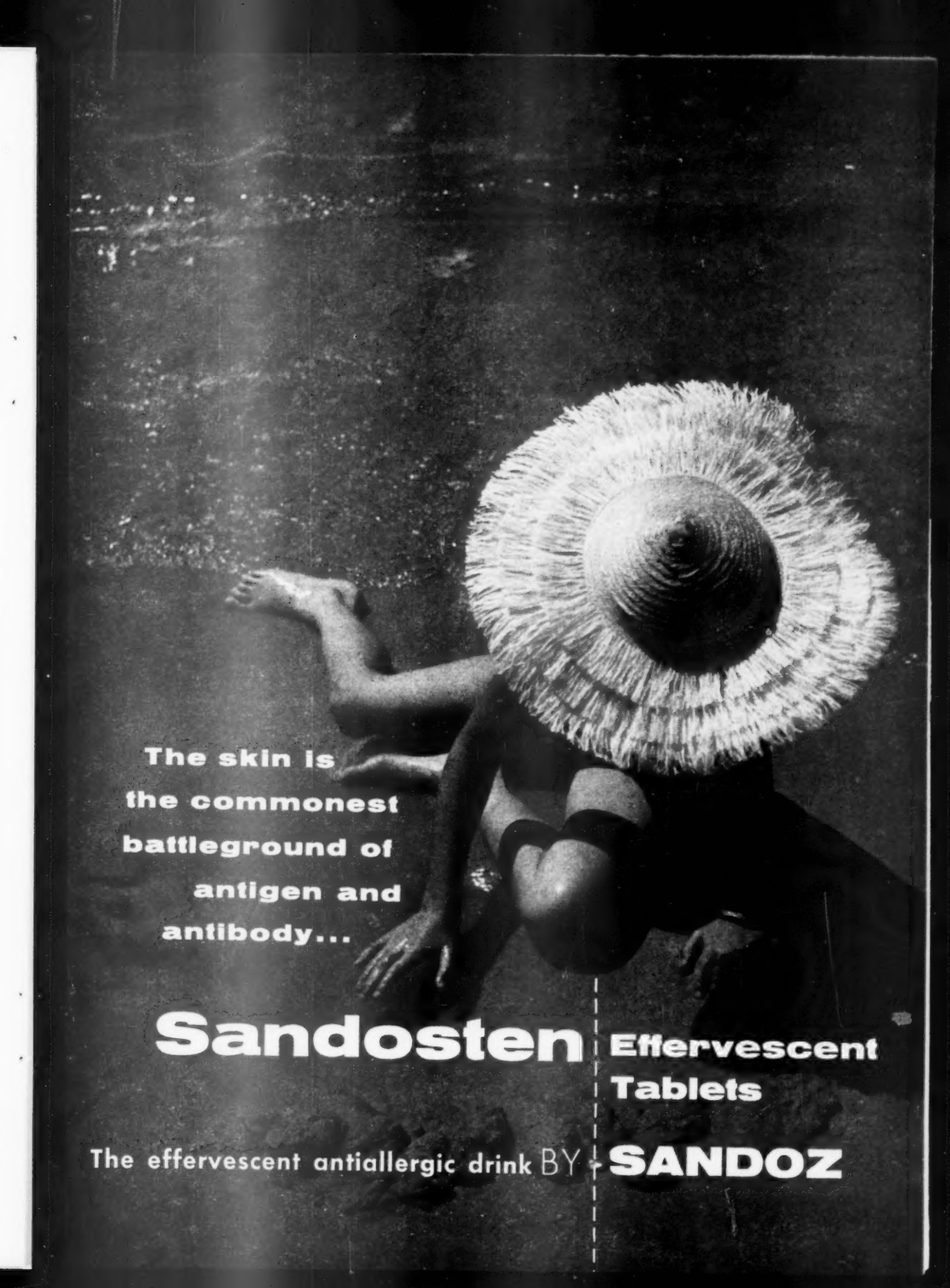
Abnormal W.B.C., large lymph nodes and spleen with typical histology.

Hashimoto's Disease.—T. A. KEMP, M.D.

Goitre with hypothyroidism and positive tests for thyroid antibodies.

Cavernous Hæmangiomata.—C. A. YOUNG, F.R.C.P.

Cavernous hæmangiomata of leg and spleen with similar lesions in several members of the family.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References: "Clinical Medicine," Vol. 5, No. 4, April, 1958; and "Ohio State Medical Journal," Vol. 55, No. 6, June, 1959.

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Section of Dermatology

President—HUGH GORDON, M.C., F.R.C.P.

Meeting
November 19, 1959
(continued from April *Proceedings*, p. 298)

Stasis Syndrome Mimicking Kaposi's Sarcoma.—P. J. HARE, M.R.C.P.

W. F., male, aged 78. Porter.

History.—Four years ago he developed an erythroderma which started as a rash on the forehead and spread within three months to involve the whole body. This was associated with gross lymphadenopathy and blood eosinophilia of 12%. He had swelling of his legs due to hypoproteinæmia. He has been successfully treated with prednisone since 1954 and has been successfully maintained on 5 mg daily. The œdema of the legs never completely disappeared.

Three months ago, firm violaceous papules 3 mm to 1 cm in diameter appeared suddenly on both lower legs. There is no frank purpura.

Clinical findings.—Numerous purple, smooth, dome-shaped papules and nodules on both lower legs. Some have become brownish. Elephantiasic warty hyperplasia on dorsum of both feet. Lymphagiectatic blebs on ankles.

Investigations.—Skin biopsies (1954): chronic eczema. Nodule on leg (September 1959): Proliferation of small blood vessels and fibroblasts. Inflammatory cells round blood vessels. Extensive free hæmorrhages. Granules in macrophages show the presence of ferric iron.

Hæmatological investigations normal.

Comment.—The case is presented as one of stasis syndrome mimicking Kaposi's sarcoma. There is at least one case on record of Kaposi's sarcoma succeeding psoriatic erythroderma, but that case was rapidly fatal. It may have been due to an angiosarcoma.

These cases are not very rare and my point is to draw attention to the differential diagnosis. I believe the present case is not one of Kaposi's sarcoma because the nodules appeared suddenly, like an exanthem. I think that he has had hæmorrhage into a leg already suffering from some degree of organized œdema and although the histological changes mimic those of Kaposi's sarcoma, there is not much new formation of blood or lymph vessels.

POSTSCRIPT (1960).—Pressure bandaging of one leg has led to considerable improvement in that leg, the other showing little change.—P. J. H.

Dr. Louis Forman: The history of an erythroderma which has progressed to the ichthyosiform hyperkeratosis which this patient now shows, suggests a prodromal cutaneous manifestation of a reticulum cell malignancy.

This pluri-potential cell may be modified by tissue œdema and could produce the vascular and connective tissue proliferation of Kaposi's disease. These considerations reinforced my clinical view that this case was one of Kaposi's disease.

Dr. Henry Haber: I think the histological picture favours a diagnosis of Kaposi's sarcoma. There is a marked proliferation of small thin-walled vessels, round-cell infiltration and rows of spindle-shaped cells between the vascular elements.

Dr. R. H. Meara: Three years ago I presented a patient with the diagnosis of Kaposi's idiopathic hæmorrhagic sarcoma (Meara, 1957) who closely resembled Dr. Hare's patient. The biopsy was reported as being compatible with the diagnosis of Kaposi's sarcoma, but while following up this patient and treating the chronic œdema of the leg by elastic bandaging there has been a remarkable improvement in her condition, and the infiltrated lesions have now become quite flat and lost the purplish colour, leaving only brown pigmentation. I would like to support Dr. Hare's suggestion that lesions simulating Kaposi's disease may occur in the stasis syndrome.

REFERENCE

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Dr. R. D. Sweet: I support Dr. Hare. In the presence of chronic œdema there is frequently proliferation of fibroblasts to form new connective tissue. This is more marked if there is a raised venous pressure when in addition masses of new capillaries are formed. Thus proliferation of fibroblasts and endothelial cells can be entirely innocent and reactive and I believe this is the case here.

The following cases were also shown:

Pyoderma Chancriformis Faciei.—Dr. LOUIS FORMAN.

Kaposi's Sarcoma.—Dr. A. B. SHRANK (for Dr. F. RAY BETTLEY).

(1) **Chronic moniliasis.** (2) **Lichen Nitidus.**—Dr. R. H. MEARA.

Two Cases of Colloid Degeneration of the Skin occurring in Brother and Sister.—Dr. R. V. HARRIS.

Facial Symptom for Diagnosis.—Dr. M. GARRETTS (for Dr. P. J. HARE).

Mr. HENRY HOBBS, read a paper entitled **Ocular Lesions after Chloroquine Therapy,** in which the corneal and retinal changes seen in patients under treatment with this drug were described and their genesis discussed.

Meeting
December 17, 1959

Argyria of Face.—A. SCOTT, M.D., M.R.C.P., and P. F. BORRIE, M.D., M.R.C.P.

F. B., male, aged 40.

Has worked for fourteen years as a metal polisher, working on fine silver finishes using an applicator containing ferric oxide. He has never used medicaments containing silver. For the past year relatives have noticed a gradual greying of his face which became quite marked during the summer, prior to his attendance.

On examination.—The skin of his face and neck, above the line of the shirt collar, was slate grey, but otherwise normal. He perspired readily on the face.

Biopsy of skin with special chemical studies of granules located in the section demonstrated the presence of silver in the cells of sweat glands, and lying free in the dermis. No evidence of iron was found.

Certain organic molecules have the ability to form internal complexes with metals. They achieve this through a property possessed by one of their contained ions (usually nitrogen, oxygen or sulphur) to share one or more electrons with a metal ion, thereby forming co-ordinate bonds. There are many naturally occurring chelates of which hæmoglobin and cyanacobalamin are two. This complex of organic compound and metal ion (the chelate) differs from its original components in stability, solubility and chemical properties. Through this means, therefore, a possibly noxious metal may be rendered harmless.

The ability of the chelating agent to effect this union depends inversely on the relative stability of the tissue metal complex; calcium and zinc are two tissue metals readily released to chelating agents. The latter are used to remove from the tissues such toxic compounds as mercury, lead and radioactive isotopes (e.g. strontium) used in therapy as well as to treat certain diseases characterized by abnormal metal metabolism involving iron (hæmochromatosis) and copper (Wilson's disease). In this case we employed the calcium and sodium salts of ethylene diamine tetracetic acid (EDTA) in a dosage of 3 g daily for four days weekly.

Urinary silver excretion increased from 0·8 to 1·8 μg daily after two months' therapy and subsequently fell to 1·0 μg a day. A course of six months is planned to permit adequate assessment.

POSTSCRIPT (5.5.60).—On completion of this course, the intensity of discoloration of the face had decreased, indeed the periphery was of near-normal hue. However, since the urinary silver excretion was still within normal range, it was difficult to decide whether the loss of silver from the skin was due to the chelator or to natural causes, such as sweating.—A. S.

Dr. I. B. Sneddon: Has Dr. Scott estimated the silver content of the skin in other workers exposed to the same working conditions? In my opinion there is a certain amount of individual idiosyncrasy in this condition; in Sheffield there are a large number of people who work with silver yet we seldom see argyria. Have any of this patient's fellow workers been investigated?

Col. P. C. Mitchell: Could Dr. Scot tell us to what degree silver is excreted in the sweat? In hæmochromatosis quite large amounts of iron can be lost in the sweat, so much so that we have advised an early case of the disease to live in the tropics. If silver can be excreted in this way, induction of sweating would be a valuable additional method of treatment.

Dr. A. Scott: I have seen only two other biopsies from patients who have worked with silver, and in neither case could we find any silver. This patient has been working for years on the metal and with other people in his work place, but none of the others has had any trouble, which tends to bear out the suspicion that there is an individual idiosyncrasy.

It is interesting that this patient has sweated excessively on the face. I have not analysed his sweat for silver, but histologically silver grains were seen in the cells of the sweat glands themselves.

Two Cases of Primary Lymphœdema.—P. F. BORRIE, M.D., M.R.C.P.

I.—M. H. J., female, aged 26.

History.—Swelling of left leg and thigh, first noticed following vaccination at the age of 4 months. Swelling of the right hand and forearm, noticed following an injury to the hand at the age of 21. Swelling of the left conjunctiva followed an attack of acute left conjunctivitis at the age of 23. The past and family histories are not relevant.

Clinical findings.—There is diffuse swelling of the left side of the face, together with chemosis on the left side. The right forearm, the lower half of the right upper arm, the left calf and the left thigh are swollen. There is *peau d'orange* in the left lower abdominal quadrant.

Investigations (Mr. G. W. Taylor).—Lymphangiography showed normal lymphatics in the left leg and thigh but no filling of the lymphatics beyond the inguinal glands. Œdema fluid from right arm contains 2·6% protein (upper level of normal 1·5%). Electrophoresis of œdema fluid shows absence of alpha-2 globulin.

II.—C. B. C., male, aged 35.

History.—Recurrent eczematous dermatitis of the fingers and hands since 1952. Swelling of the right hand and forearm began during the fifth attack in 1956. Since that time it has recurred with each subsequent attack, almost completely

disappearing between attacks. Past and family histories negative.

Clinical findings.—Bilateral eczematous dermatitis of the backs of the fingers and hands with swelling of the right hand and forearm.

Investigations (Mr. G. W. Taylor).—Lymphangiography in May 1957 showed lymphatic hypoplasia in the right upper arm ("solitary" type).

Comment.—These 2 cases of primary lymphatic hypoplasia show how misleading is the generally accepted term "primary lymphœdema", since in 3 out of the 4 affected areas in the first case the œdema followed trauma or infection and in the second case it followed eczematous dermatitis. The œdema sometimes seen associated with rosacea probably derives in a similar manner and a lymphatic hypoplasia has been demonstrated in the few cases we have investigated. Recurrent cellulitis, occurring for no apparent reason, results in lymphœdema if it occurs frequently enough. Arguing from the cases shown to-day, it may be that primary lymphatic hypoplasia exists prior to this type of cellulitis, the latter merely unmasking the condition by increasing the tissue fluid beyond the level at which the lymphatics are capable of dealing with it.

One of the main tasks of the lymphatics is to drain from the tissue fluid substances of high molecular weight and the first result of lymphatic hypoplasia is an increase in the concentration of protein in the tissue fluid. This could provide an excellent culture medium for pathogenic organisms and so lead to repeated infection. Cases of recurrent cellulitis of the leg associated with fungus infection of the feet are rare considering how common is that type of fungus infection. They may well occur only in individuals with hypoplastic lymphatics, the fissures resulting from the tinea providing a portal of entry for streptococci. In my experience, cure of the fungus infection does not always abolish the recurrent cellulitis.

Dr. B. Solomons: I was specially interested in Case II. I do not consider he falls into the category of lymphœdema described by Dr. Borrie, especially as chronic lymphœdema may occur without abnormal lymphatics; infection is often sufficient to cause lymphœdema with or without hypoplasia of the lymphatics. His theory is, however, attractive. The other patient appears to be a genuine case of congenital lymphœdema.

Dr. Louis Forman: I would like to ask Dr. Borrie if he believes that permanent œdema of a limb or ear can only occur following a skin infection, if there is a congenital paucity of lymphatic channels.

Recurrent erysipelo-cellulitis of the ear associated with fissuring of the external auditory meatus and fever responds favourably to antibiotics if given in an acute phase. The degree of œdema in the treated cases is less severe and less prolonged. In other words the infective element would appear to be of primary importance, although, if Dr. Borrie is correct, the œdema would only be severe if the patient had a developmental deficiency of lymphatics.

I believe that a degree of œdema of the face with rosacea, if long standing, is common and indeed inevitable, particularly in the presence of a pustular element. The œdema graduates from slight to severe. It is bilateral affecting the orbits, cheeks and nose. If Dr. Borrie's views are sustained, and they are extremely important, then all patients with œdema following rosacea should have a developmental agenesis of lymphatic channels.

Dr. Brian Russell: May I ask Dr. Borrie what proof there is that the lymphatics are underdeveloped or absent in these patients? Case II described recurrent lymphangitis extending up his arm. What proof is there that the lymphatics have not been obliterated as a result of this lymphangitis?

Dr. P. F. Borrie: My thesis is that infection, trauma or permanent vasodilatation may lead to lymphœdema, but only in those individuals in whom there is a pre-existing abnormality of the lymphatics. Clearly, therefore, the sooner the infection, etc., is dealt with, the less will be the subsequent lymphœdema. In my experience, the degree of œdema seen in rosacea does not reflect either the severity or the duration of the rosacea.

Radiographic evidence, obtained by injecting radio-opaque material into the lymphatics and showing lymphatic hypoplasia, was on view with each patient.

Dr. C. D. Calnan: The experimental work is in fact in favour of Dr. Borrie's point of view. Drinker, I believe, deliberately interfered with the lymphatics in dogs to produce œdema and found that the limb became more susceptible to recurrent streptococcal infection.

The following cases were also shown:

Reticulosis.—Dr. C. F. H. Vickers (for Dr. I. B. Sneddon).

Malabsorption Syndrome: Bronchiectasis, Lichenoid Eruption.—Dr. R. M. B. MacKenna.

Subcorneal Pustular Dermatosis.—Dr. A. Scott.

Thyrotoxicosis; Circumscribed Myxœdema; Exophthalmos.—Dr. M. A. Smith (for Dr. P. F. Borrie).

Mycosis Fungoides.—Dr. M. A. Smith.

Nævoxanthoendothelioma.—Dr. E. Lipman Cohen.

Angiomatosis with Atrophy.—Dr. P. J. Hare.

Psoriasis Treated with Triamcinolone and Vitamin A.—Dr. A. Jarrett.

Hypostatic Changes resembling Kaposi's Idiopathic Hæmorrhagic Sarcoma.—Dr. Brian Russell.

Mycosis Fungoides.—Dr. P. Hall-Smith.

Linear Lichen Planus, Vitiligo and Leukotrichia with a Past History of Alopecia and Morphœa.—Dr. John Morgan.

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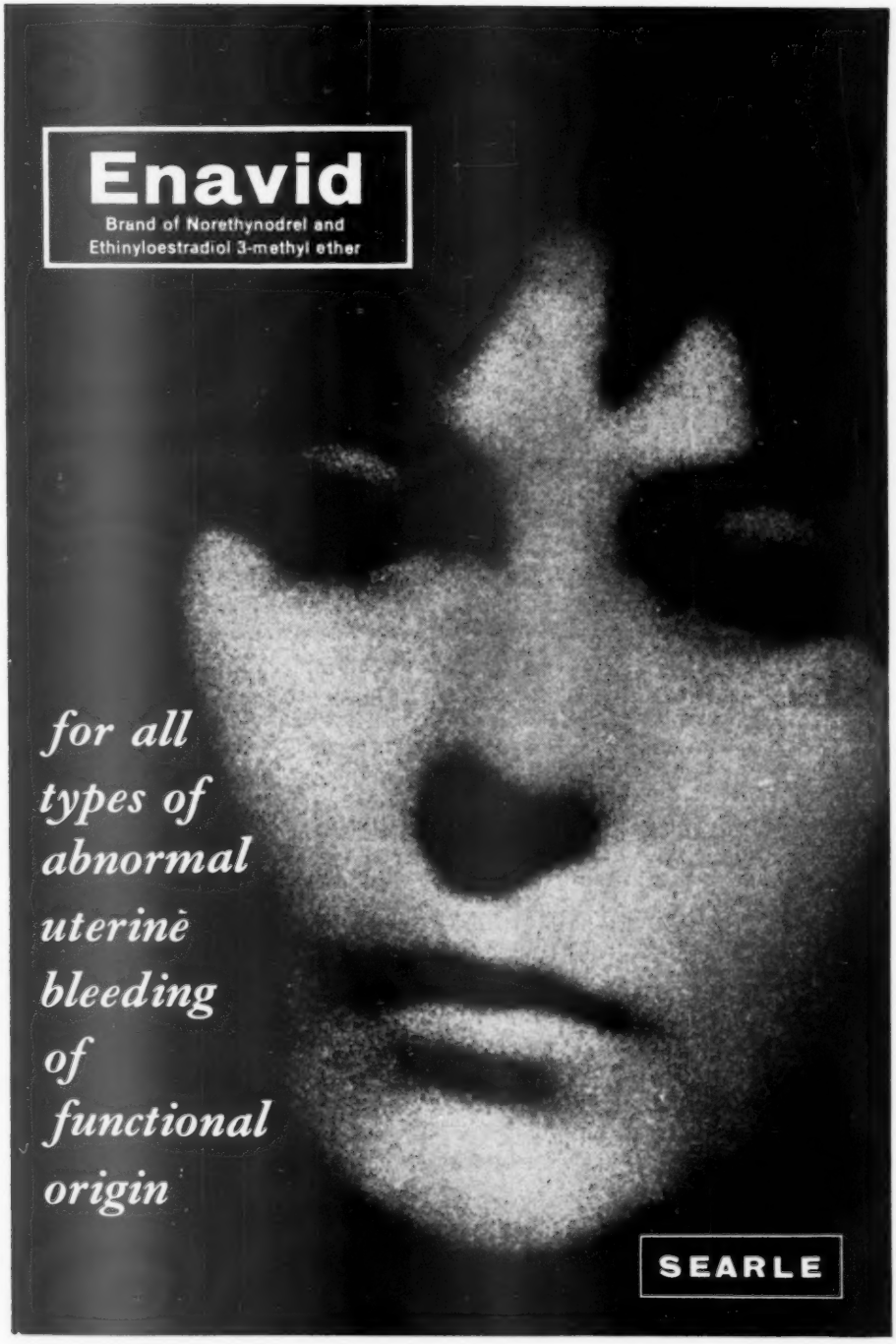
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BOOK REVIEWS

A Textbook of Human Embryology. By R. G. Harrison, M.A., D.M. (Pp. xi+244; 144 illustrations. 45s.) Oxford: Blackwell Scientific Publications. 1959.

There are many well-tried textbooks of human embryology, scholarly and pedagogically excellent, but all inflated with detail to a size which makes them a trial to most medical students. A book is needed of about the scope of Professor Harrison's, based on consideration of what an ordinary medical student in an ordinary medical course can gain from embryology. The primary function is no doubt to be an aid in grasping anatomy, normal and malformed. For this the book is good: it is clear and balanced and well based on modern descriptive work, though, since the vigilance of no writer is perfect, some refining of careless statements will naturally be needed in later editions. A flavour of experimental work is necessary to prepare the student for future advances that may impinge on medicine: in this admittedly less important aspect, the book is a little disappointing. It is no doubt the incoherence of the subject that makes it so notoriously difficult to give a clear or even reasonably accurate exposition of the experimental analysis of early development. Professor Harrison has tended to pick out one or two papers about each system, and when his choice is unrepresentative the consequence can be an unbalanced picture of the state of knowledge, as in the important topic of sex differentiation. The book is very well produced.

Angiologie. Edited by Prof. Dr. Max Ratschow, F.A.C.A. (Pp. 831; 373 illustrations. DM. 174.) Stuttgart: Georg Thieme Verlag. 1959.

In this work, Professor Ratschow, the well-known authority on angiology, has produced an exhaustive presentation of the subject with the collaboration of 25 co-authors, each an expert in his particular subject. The book consists of two main parts, General, and Special Angiology. The main chapters of "General Angiology" are: Anatomy, normal and pathological physiology and pathology of blood vessels, ætiology of circulatory disorders, diagnostic methods, general principles of treatment. In the part dealing with "Special Angiology" of the peripheral vessels, the conditions are divided into those due to nervous factors (particularly Raynaud), to structural changes of the larger vessels, and to abnormalities of the terminal vessels. In his own contributions, outstanding for their clarity, the editor has succeeded in consistently keeping the discussion of a particular aspect within the scope of the main context. In some of the other, particularly the more highly specialized, sections the physician will sometimes find it difficult not to lose sight of the main trend, the discussions going into too many details and the terminology being at times rather involved. For the specialist in angiology, this monograph is likely to remain a standard work for a considerable time, owing to the expert comprehensive treatment of the subject and the admirable bibliographies, containing international references up to 1959. The production of the book and the illustrations are admirable.

Coronary Heart Disease. By J. W. Gofman, M.D., Ph.D. (Pp. xx+353. 60s.) Springfield, Ill.: Charles C Thomas. Oxford: Blackwell Scientific Publications. 1959.

In this book the author does not set out to present current knowledge on coronary heart disease, which is now better termed ischæmic heart disease. Instead he elaborates the views of the group at the Donner Laboratory, in the University of California, on the detection of those who are candidates for the disease, before it has become manifest clinically. The importance of the blood lipids is stressed without economy in the use of words. There is a good explanation of the information that can be obtained from the ultracentrifuge, and on relevant nomenclature. The claim that the "atherogenic index" is of predictive value is pressed, but it is not generally accepted to be of greater value than estimation of the plasma cholesterol. Familial aspects of the disease are considered in relation to the "atherogenic index", together with factors such as age, sex, overweight, diet, smoking and stress, and the question of therapeutics.

Lectures on the Interpretation of Pain in Orthopedic Practice. By Arthur Steindler, M.D., Hon.F.R.C.S.(Eng.), F.A.C.S., Hon.F.I.C.S. (Pp. xvii+733; illustrated. £7 8s.) Springfield, Ill.: Charles C Thomas. Oxford: Blackwell Scientific Publications. 1959.

This is the last book written by a great man and is published in the year of his death at the age of 81, a final monument to his tremendous energy and industry. How difficult it is to describe and differentiate something so essentially subjective as pain; like the songs of birds, it can never be put adequately into words. But Dr. Steindler comes as near success as any man could, and uses the element of pain as a tag on which to hang a discourse covering most of orthopædics. This is not a very satisfying method of approach, but it is often a stimulating

one. Like much of the author's work it makes rather heavy reading but the experienced surgeon will find this book most rewarding.

Surgery of Repair as Applied to Hand Injuries. By B. K. Rank, C.M.G., M.S.(Melbourne), F.R.C.S.(Eng.), F.R.A.C.S., and A. R. Wakefield, M.S.(Melbourne), F.R.C.S. (Eng.), F.R.A.C.S. 2nd ed. (Pp. xiv+283; illustrated. 45s.) Edinburgh and London: E. & S. Livingstone Ltd. 1960.

The second edition of this admirable book—the first appeared in 1953—is very welcome. Both the authors are plastic surgeons, but both have very wide experience also of the primary treatment of the injuries which, when inadequately dealt with, provide the plastic units with some of their most difficult and sometimes insoluble problems. Hence a large part of the book concerns early treatment, and it is here that it makes its widest appeal. True experience is only accumulated by personal trials and errors; this book aims to reduce the latter, an aim in which it will certainly succeed. It takes for granted a little more knowledge than the newly qualified casualty officer can possess, but it will make easy and profitable reading for registrars and their seniors.

Brucellosis in England. By Hugh R. E. Wallis, B.A., M.D., M.R.C.P., D.C.H. (Pp. 140. 25s.) London: A. S. O'Connor & Co. Ltd. 1959.

This little book, by the Consultant Pædiatrician of the Bath Clinical Area, is founded on 42 cases of illness in children diagnosed as suffering from brucella infection, an infection which has usually been regarded as uncommon in children, though there is now some reason to doubt this.

This account is, therefore, of value both because it draws attention to the possibility of this diagnosis in children, and also for the interesting clinical features described. But for most workers in this field its value will be greatly reduced by the author's employment of diagnostic criteria in which the intradermal test, the rise in agglutination titre following this test, and the response to treatment with antibiotics carry far more weight than is generally considered justifiable (see for instance Third Report, Joint F.A.O./W.H.O. Expert Committee on Brucellosis). If the number of missed cases of undulant fever in this country is to be reduced to a minimum and many patients saved from inappropriate treatment or stigmatization as "neurotics" it will be necessary to steer a middle course between the rejection of all cases in which the organism cannot be isolated, and the opposite policy (adopted by the present author and by Dr. H. J. Harris of New York State, who contributes an introduction) of spreading the net so wide that the whole diagnosis of the disease is in danger of being brought into disrepute.

Brucella Infection and Undulant Fever in Man. By Sir Weldon Dalrymple-Champneys, Bt. (Pp. xii+196; illustrated. 25s.) London: Oxford University Press. 1960.

This book is based primarily on the author's record of 1,500 cases seen personally by him during the period 1929–1957, but an account is given of the disease as it occurs in other countries and reference is made to most of the important published work, particularly as it affects the disease in human beings.

A concise account is provided of brucella infection in man covering the history of the disease, the nature of the infecting organism, the animal reservoirs from which it is derived, the incidence, clinical features, diagnosis and prognosis in man, together with prevention and treatment.

The author presents his material in a vivid and interesting manner, with independence of thought and a broad epidemiological outlook, attaching due weight to the general and to the exception.

This is a book which can be recommended to all interested in brucella infection.

Chemical Quantitation of Epinephrine and Norepinephrine in Plasma. By William Muir Manger, B.S., M.D., Ph.D., Khalil G. Wakim, M.D., Ph.D., and Jesse L. Bollman, M.D. (Pp. xiii+398; illustrated. 87s. 6d.) Springfield, Ill.: Charles C Thomas. Oxford: Blackwell Scientific Publications. 1959.

This book consists simply of a short review of fluorometric methods for estimating adrenaline and noradrenaline in plasma by a method modified from that of Weil-Malherbe and Bone. Some evidence is produced to justify the specificity of this method, though no complete answer is given to the criticism that the results are not always correlated with biological assays and that the fluorescence reaction is known to be non-specific and perhaps rather variable in different hands. However, the authors use this reaction to measure the adrenaline-like substances present in the plasma in a variety of conditions both clinical and experimental. The main clinical conditions studied are phæochromocytoma, hypertension of various types, hæmorrhage and mental disorder. It cannot be said that anything very striking has come out of these studies and some of the results are perhaps surprising, even in cases of phæochromocytoma where the position has seemed fairly clear. They claim that,

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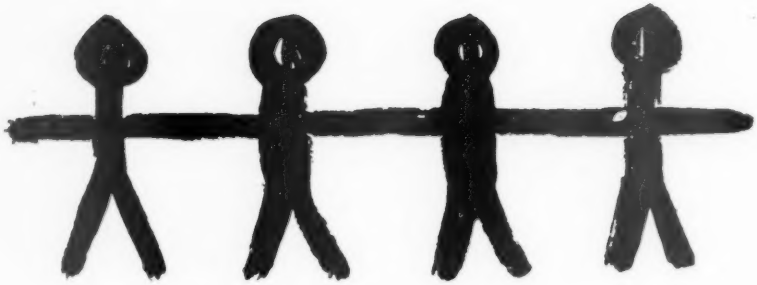

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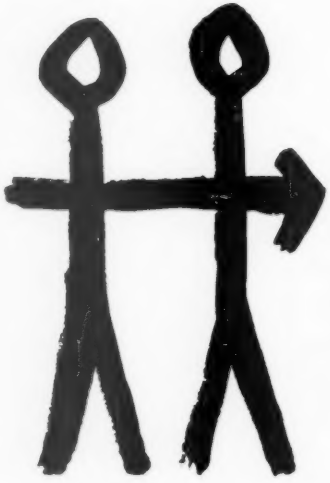

The diabetic population of Great Britain numbers almost 500,000 – yet only about half of them are known and under treatment. Statistically this means that every general practitioner has more than ten undetected diabetics in his care.
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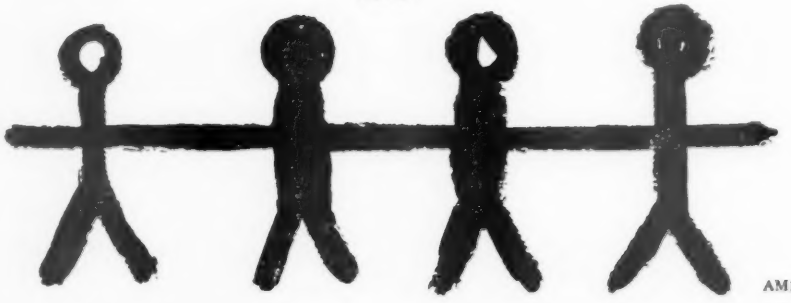

AM142

fairly uniformly in 23 cases, there seemed a much greater change in the adrenaline levels compared with noradrenaline after removal of the tumour. Most of these tumours secrete more noradrenaline than adrenaline, as has been shown by many workers. The weakest point perhaps of the Weil-Malherbe and Bone method is this discrimination between adrenaline and noradrenaline. Used as a total fluorescence technique, it makes a useful screening test, like that previously used by Goldenberg.

The Process of Ageing in the Nervous System. Edited by James E. Birren, Ph.D., Henry A. Imus, Ph.D., and William F. Windle, Ph.D., Sc.D. (Pp. xii + 224; illustrated. 52s. 6d.) Oxford: Blackwell Scientific Publications. 1959.

In the last decade the medical reader has been bombarded with the proceedings of symposia and colloquia. They serve a useful purpose and are particularly valuable on account of the faithful reporting of the spontaneous discussions which follow the papers. Irrespective of their sponsorship (whether by the National Institutes of Health, CIBA or CIOMS) these symposia now have a common pattern and a happy informality which makes the reader feel that he is one of the group and how often does he wish he could interpolate a sentence in these discussions! Some of them suffer from being too general and too full so that there is no time for an exciting theme to be debated to the limits of knowledge. But planning on a wide front is sometimes purposely designed to bring together persons of different disciplines whose work is attuned to the same end. For this reason the contributions may bear little relation to each other. A reader of symposia proceedings must inevitably conclude that more useful results would be achieved if the conferees were privileged to know each other and their problems before meeting.

The present Bethesda symposium, attended by 32 experts in January 1957, suffers from having been too diffuse and the time devoted to it too short. In two days the subjects debated ranged from factual evidence of the ageing process to the neuropathology of Alzheimer's disease, from electron microscopy to histochemistry and from the thalamus to the posterior root ganglia. Nevertheless there is much of interest in this monograph which, apart from four round table discussions, contains eleven papers. Particularly valuable are the contributions of Dr. Dempsey on submicroscopic detail of the cortical cells and the neuropile and of Dr. Sokoloff on the circulation rate in elderly subjects. Notable too is the obvious revival of interest in lipofuscin.

Chronic Illness in a Rural Area. Vol. III of Chronic Illness in the United States. By Ray E. Trussell, M.D., M.P.H., and Jack Elinson, Ph.D. (Pp. xiv + 440. 60s.) Cambridge, Mass: Harvard University Press (Commonwealth Fund). London: Oxford University Press. 1959.

This is the last of a series of four volumes on chronic illness in the U.S.A. The three previous books were on chronic illness in a large city, on the care of long-term illness and on prevention of chronic illness.

A report is presented of an intensive survey carried out at the Hunterdon Medical Centre in rural New Jersey by the Commission on Chronic Illness. The aims were to work out methods to estimate the prevalence of chronic illness and the extent of disability in this rural community.

The methods used included personal questionnaires, family interviews, information from local family doctors, clinical examination of a sample and multiple screening tests.

The results obtained cast serious doubts on previous studies, and also demonstrate the deficiencies in the existing medical and social services. It was considered that one-third of all chronic and disabling illnesses seen were preventable and that two-thirds of the patients were receiving unsatisfactory or inadequate care.

Being a report of a large community survey the text is rather overfilled with facts, figures and tables, but there is a most excellent first chapter that presents the "highlights" in a readable and concise form in a little over 35 pages, and having read this one can then pick out the subjects that one is interested in from the text. Naturally these are the findings of an American investigation; it would be very interesting to try and compare the situation as it exists in Great Britain under the National Health Service.

Pædiatric Neurosurgery. Edited by Ira J. Jackson, M.D., M.Sc., F.A.C.S., F.A.C.A. and Raymond K. Thompson, M.D., F.A.C.S. (Pp. xvi + 564; illustrated. £6 5s.) Springfield, Ill.: Charles C Thomas. Oxford: Blackwell Scientific Publications. 1959.

The authors have set out to provide a textbook covering all aspects of pædiatric neurosurgery and certainly the general form of the work is satisfactory. In their desire to be comprehensive, chapters on the surgical treatment of epilepsy and leucotomy have been included somewhat unnecessarily, for the former is more than adequately covered in the writings of Penfield whilst leucotomy has been shown to be of no value in children. The section on brain tumours is well arranged, highly informative but poorly illustrated so far as radiographs are concerned and

contains an occasional error such as that medulloblastomas occur predominantly in males. This results from drawing conclusions from small numbers of cases—the true sex incidence is two males to one female.

Whilst the authors go into minute detail over many matters, they tend to be inconsistent in this respect, leaving out practical points of importance which should have been included as, for instance, the end-results of treatment of infantile subdural hæmatoma.

The book is extensively illustrated with good photographs of a high standard of reproduction but the radiographs on the whole are of poor quality.

The impression is gained that the majority of the authors, with certain notable exceptions, are relatively inexperienced in pædiatric neurosurgery and the work as a whole is not a very useful contribution to the literature.

J.-M. Charcot, 1825–1893; His Life—His Work. By Georges Guillain, M.D. Edited and translated by Pearce Bailey, Ph.D., M.D. (Pp. xvi+202; illustrated. 50s.) London: Pitman Medical Publishing Co. Ltd. 1959.

This is a biography of the greatest figure in French neurology written by his talented spiritual descendant and eventual successor in office, Georges Guillain. It is a succinct yet vivid account of a colourful personality, of the days in which he lived and of the historic hospital which he transformed from a prison for disreputable women into a renowned centre for neurological research.

Charcot was the son of a carriage builder and his mother had not yet attained her seventeenth birthday when he was born, the second child in the family. It was during the fruitful years 1862 to 1870 that he made the most of his major contributions to medicine: then came the war. We have a picture of him in his open carriage halted by the soldiers of the Commune and impelled by the crowd to help build barricades: but he continues on his way, for this dominating personality has work to do at the Salpétrière where he is the acknowledged dictator of policy. In 1881 the chair of neurology was created for him and six years later he was elected to the Academy of Sciences, surprisingly late for one long recognized as the world authority on all neurological matters. To his famous Tuesday soirées (he lived at 217, Boulevard St. Germain) came the leaders of science, of the arts and of society. Here his pupils would meet Alphonse Daudet, Ribot and Falguière and such dignitaries as the Emperor of Brazil, the Cardinal Lavigerie and grand dukes from Russia. On these occasions the stern yet sentimental father would be surrounded by his adoring family of offspring and disciples. His influence was felt far and wide. It was, we are told, because of him that the consummation of the Franco-Russian alliance was made possible.

This is a charming biography and the English-speaking world will be sincerely grateful to Dr. Pearce Bailey, the translator, for making this "American" edition available. Particularly welcome are Dr. Pearce Bailey's explanatory footnotes and his own introduction to the book, a veritable essay of appraisal of Charcot's place in neurology, written with full understanding of his subject and love of the French scene Charcot he says was "an acute observer and a prodigous classifier". His influence is still profound and in very truth "he belongs to the world".

The Surgical Treatment of Scoliosis. By Louis A. Goldstein, M.D., F.A.C.S. (Pp. xi+416; illustrated. 54s.) Springfield, Ill.: Charles C Thomas. Oxford: Blackwell Scientific Publications. 1959.

This monograph describes the technique and results of treatment in a series of 65 cases of structural scoliosis by turnbuckle plaster cast and spinal fusion. The indication for such treatment in idiopathic scoliosis is significant increase of the deformity during the growth period, or a severe deformity which diminishes function. Paralytic scoliosis is treated more intensively from the outset, with plaster correction and braces in addition to stretching exercises, but the author does point out that controversy still exists regarding the effectiveness of conservative treatment, and the age at which spinal fusion should be carried out.

The type of turnbuckle cast used is that described by Risser and modified by Cobb. The method of application is described in detail, and in the technique of spinal fusion since 1952 fresh autogenous iliac bone has been used almost exclusively, and Barr's hand gouge method avoiding the use of a mallet is advocated.

The turnbuckle cast is applied for six months and this is followed by the use of a bent cast for two more months' recumbency prior to an ambulatory bent cast. A celluloid jacket may subsequently be employed in paralytic cases. During immobilization the daily exercise programme is important for the jaws, arms, knees, ankles and feet.

Complications were not common. There were no deaths.

The end-results are analysed in some detail and there is a final chapter on anæsthetics. This practical book is well produced with very clear illustrations and a useful list of references, and can be recommended to all those who have to deal with the difficult problem of scoliosis.

Speech and Brain - mechanisms. By Wilder Penfield and Lamar Roberts. (Pp. xiii+286; illustrated. 35s.) Princeton, N.J.: Princeton University Press. London: Oxford University Press. 1959.

The chapters in this book are founded on the Venuxem Lectures delivered at Princeton in 1956 and are supplemented by much interesting data, some from the pen of Dr. Lamar Roberts.

Since Fritsch and Hitzig first applied an electrode to the exposed cortex of a dog in the year 1870 much work has been done on the localization of function within the cerebral cortex and in the last two decades the contribution of the surgeons, under the notable lead of Dr. Penfield, has been impressive. Experience in the ablation treatment for temporal lobe epilepsy has opened a remarkably interesting chapter of our knowledge of brain function. Particularly helpful is the historical account of the development of our ideas on the cortical siting of speech, commencing here with the little-known report by Marc Dax (1836) and with the now classical patients of Broca, Leborgne and Lelong. Dr. Penfield concludes, as a result of his experience of 522 appropriate cases, that the left hemisphere is dominant for speech regardless of handedness. In the course of a century there have been reports on only 140 cases of right-sided dominance and in his view the phenomenon is not related solely to handedness.

In the final chapter Dr. Penfield sets out his views on the schooling of language, views which are important because they are founded on his unique experience gained as a cortical cartographer in a bilingual city.

Night Vision. By Gaétan E. Jayle, Albert G. Ourgaud, L. F. Baisinger, M.D., and William John Holmes, M.D. (Pp. xiv+408; illustrated. £5 8s.) Springfield, Ill.: Charles C Thomas. Oxford: Blackwell Scientific Publications. 1959.

This is an outstanding monograph of an extremely comprehensive character. The subject of night vision has attracted much scientific and experimental work. This is efficiently summarized, and critical judgments are passed on the competing theories. There is a comprehensive chapter on variations of night vision under pathological conditions which will attract the clinical ophthalmologist.

Night driving is discussed in great detail. On a mileage basis the death rate from accidents occurring at night in rural areas exceeds the day rate by about two and a half times. In cities the night death rate is about four times that of the day rate, although only 25% of vehicles are in circulation at this time. Studies on drivers showed that dangerous fatigue begins after three to five hours of driving, the signs being insufficiency of convergence, heaviness of the eyelids, a foreign body sensation, and subjective visual changes, all of which should warn the driver to stop in time.

Night flying brings its own range of problems, and has attracted numerous studies, not all yet published in detail because of military security. The authors discuss the findings as far as they are available.

The monograph demands rather a high standard of mathematical and biochemical knowledge from its readers, but it can be thoroughly recommended.

Orthopædics: Principles and Their Applications. By Samuel L. Turek, M.D. (Pp. xix+906; profusely illustrated. £8.) London: Pitman Medical Publishing Co. Ltd. 1959.

Dr. Turek has set himself a mammoth task in collecting, sifting and correlating the basic scientific knowledge which must be the foundation of orthopædics, or of any other specialty for that matter. So vast has the subject of modern orthopædics become that even a book of this size can give only a brief summary of many conditions which, although uncommon, provide much of the worry and puzzlement to a practising surgeon. This is the era of the monograph: there is a diminishing place for compendium textbooks, which can never satisfy the specialist who, in contradiction of the old tag, has to know more and more about more and more. Within these limitations, however, the author has made a brave and in the main successful attempt to sift the grain from the chaff and present it in palatable form, and has produced a valuable reference book for those studying for degrees in orthopædic surgery.

The Treatment of Bronchial Neoplasms. By Robert R. Shaw, M.D., and Donald L. Paulson, M.D. (Pp. xv+135; illustrated. 64s.) Springfield, Ill.: Charles C Thomas. Oxford: Blackwell Scientific Publications. 1959.

A concise account is given of the treatment of 1,215 patients suffering from bronchial carcinoma or adenoma in the years 1945 to 1957. During the period, the authors became progressively less impressed with heroic surgery. They now regard lobectomy as the operation of choice, although pneumonectomy is still necessary in about one-half of the resections because of the site of the growth or mediastinal glandular involvement.

Bearing in mind the limitations of surgery, they advocate the extended application of irradiation and chemotherapy. Their results, which are carefully tabulated, differ little from similar published series.

Much emphasis is placed upon the natural history of bronchial carcinoma. The "classical temporal theory", which implies that the early and wide excision of the growth and regional lymph nodes is the most important factor in prognosis, is rejected in favour of the "theory of biologic determinism", in which the cell type, site and resistance of the host determine the pattern of behaviour and prognosis. This implies that the degree of differentiation of the neoplastic cells is often more important than the age of the tumour.

Bronchial carcinoma is a disease of considerable medical importance and a steady flow of reports from experienced workers will ensure that current methods of diagnosis and treatment are widely known. This volume, in which orthodox views are restated, will help to serve these ends. Unfortunately, the heavy style of writing is likely to dismay many readers.

The Ætiology and Arrest of Pre-eclamptic Toxæmia with Early Ambulant Treatment. By K. Douglas Salzmann, M.D., M.R.C.P. (Ed.), D.Obst.R.C.O.G. (Pp. viii + 69. 10s. 6d.) London: H. K. Lewis & Co. Ltd. 1960.

This small book deals mainly with the prevention and treatment of toxæmia of pregnancy from the point of view of the general practitioner.

The author believes that toxæmia is caused by vasospasm and certainly his theory well fits most of the known facts. The difficulty is to explain why vasospasm occurs in some women and not others, and why eclampsia may occur after delivery. This difficulty bedevils all attempts to find a reasonable explanation for the occurrence of toxæmia.

His description of the care he gives his antenatal cases is admirable and shows what can be achieved by any general practitioner who is prepared to take a little extra trouble. Especially commendable is his advice that antenatal patients should be given appointments and should not attend in general surgery hours.

His treatment is based on the use of reserpine. While the results obtained with this are good, the last word has certainly not been said on the question of hypotensive drugs and their use in the prevention and treatment of toxæmia of pregnancy.

This book should certainly be studied by general practitioners who undertake maternity cases and has much of interest to offer to the obstetrician.

Heritable Disorders of Connective Tissue. By Victor A. McKusick, M.D. 2nd edit. (Pp. 333; illustrated. 90s.) St. Louis: The C. V. Mosby Company. London: Henry Kimpton. 1960.

This book is a complete guide for the rare-syndrome hunter and it will enable him to label particular specimens accurately and confidently.

Here are found those familial, but not familiar, developmental syndromes which produce generalized abnormalities mainly in connective tissue; they are displayed with such a wealth of photographs and diagrams, and documented by such a manifold array of references, that it is impossible to imagine a more complete and authoritative work. Anyone who is uneasy about the exact difference between the dermo-chondro-corneal-dystrophy of Hurler and Pfaundler, craniofacial dysostosis of the Crouzon type, and Léri's familial pleonosteosis, will find every subtlety of this esoteric distinction amply discussed. The chapter on Hurler's syndrome is fortified by over one hundred and seventy references and a clinician seeking more extensive knowledge of the finer points will find all the references, to the Excretion of Sulfated Muco Polysaccharides in Gargoylism and many other such relevant topics.

Though the book seems to be a Super Specialised Guide for Super Specialists the preface reveals that "It is especially the generalist—the general practitioner and the internist (junior houseman) without particular subspecialization to whom the several syndromes discussed here are of importance, and to whom this book is addressed". This sentence in an English reader produces some quaking of the knees, coupled with a quota of respectful awe as he vainly tries to imagine the kind of book the *real* American specialists must read. Without such an exposition of the book's purpose he might hastily have concluded that rarely in the production of medical literature has so much been written about so little for so few.

Practical Allergy. By M. Coleman Harris, M.D., F.A.C.P., and Norman Shure, M.D., M.S., F.A.C.P. (Pp. xiii + 471; illustrated. 52s. 6d.) Philadelphia: F. A. Davis Company. 1957.

This book is published in this country by Butterworth & Co. (Publishers) Ltd. For review *see* April *Proceedings*, p. 301.

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